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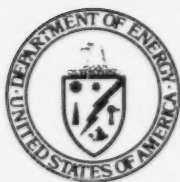
Safety



Health

at

DOE Facilities



**Annual Report
Fiscal Year 1980**

U.S. Department of Energy
Assistant Secretary, Environmental Protection, Safety, and Emergency Preparedness

July 1981

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U.S. Department of Energy
Assistant Secretary, Environmental Protection, Safety, and Emergency Preparedness
Washington, D.C. 20585

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PREFACE

This report on environmental protection, safety, and health protection has been prepared in accordance with the requirements of U.S. Department of Energy Order DOE 5480.1 "Environmental Protection, Safety, and Health Protection Program for DOE Operations."

Reporting of performance with respect to health and safety began with the war-time Manhattan Engineering District in 1943 and was continued with the formation of the Atomic Energy Commission in 1947. Consolidated reports of cumulative agency experience, including Manhattan Engineering District data, have been published periodically since at least 1956. Early reports focused on radiation exposures, contaminations, and criticality accidents due to the Atomic Energy Commission's singular involvement in nuclear technology. However, it became apparent that radiation-related occurrences accounted for a minority of the accidents or incidents experienced by the Commission, and the 1956 report stated: "By far the most numerous (accidents) are those in no way related to atomic energy." In 1965, the Atomic Energy Commission gathered available information, descriptions, and statistics regarding disabling injuries, radiation exposures, contaminations, criticalities, fatalities, and property damage for the period 1943-1964 and published a report entitled "Operational Accidents and Radiation Exposure Experience Within the United States Atomic Energy Commission 1943-1964," Document No. WASH-1192. It provided the general format for later reports.

The 1970s brought numerous changes that affect the current organization and its operation:

- The Atomic Energy Commission's nonregulatory functions were transferred on January 17, 1975, to the Energy Research and Development Administration, and on October 1, 1977, the Energy Research and Development Administration was absorbed by the Department of Energy.
- Areas of responsibility were expanded to include production, distribution, and regulation of fossil fuels, geothermal energy sources, hydroelectric generation, and solar energy.
- Capital investments increased to a replacement value exceeding \$50 billion.
- Extensive Federal environmental and health and safety legislation, such as the Clean Air Act, Clean Water Act, National Environmental Policy Act, and the Occupational Safety and Health Act, was passed.

In recognition of these far-reaching changes and the impact that they have on the Department and its activities, the annual report published by the Operational and Environmental Safety Division, "Operational Accidents and Radiation Exposures at DOE Facilities," has been revised for the current year to more completely reflect the Department's total ES&H Program. The report generally reflects the ES&H Program and related events for fiscal year 1980. However, some deviations do occur to provide the reader with a better understanding of the program, organizational responsibilities, and the Departmental authorities that describe and guide the ES&H effort. For instance, the report refers to the Assistant Secretary, Environmental Protection, Safety, and Emergency Preparedness, rather than the Assistant Secretary for Environment even though the organizational change occurred in calendar year 1981. Similarly, Departmental orders that were finalized and promulgated after the end of fiscal year 1980 are referred to when describing program elements and procedures. This year's report provides a brief program description and features selected program elements -- appraisal program, training, emergency preparedness, environmental protection, occupational safety and health, radiation protection, and the fire protection program. Basic statistical data on fatalities, injuries, property loss, and radiation exposures are also included, as in past reports, to provide a means of evaluating the effectiveness of the Department's overall ES&H Program.

This first effort to expand the annual report is less than fully comprehensive. Future reports will continue to evolve and become more representative of the total ES&H Program, with the emphasis continuing to be on the operational elements of the program.

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SUMMARY

The Department of Energy's occupational safety and property protection performance in fiscal year 1980 was excellent in all reported categories with loss rates generally less than one-third of comparable industry figures (Figure 1).

The Department of Energy's fiscal year 1980 incidence rate per 200,000 work hours was 1.1 lost workday cases and 18.2 lost workdays compared to 1.1 lost workday cases and 17.2 lost workdays during fiscal year 1979. The recorded occupational illness rate, based on only 70 cases, was 0.05 cases per 200,000 work hours compared to 0.06 cases per 200,000 work hours for fiscal year 1979. Ten fatalities involving Federal or contractor employees occurred in fiscal year 1980 compared to nine for fiscal year 1979. Four of those in fiscal year 1980 resulted from two aircraft accidents.

Total reported property loss during fiscal year 1980 was \$7.1 million with \$3.5 million attributable to earthquake damage sustained by the Lawrence Livermore and Sandia National Laboratories on January 24, 1980. Fire losses during the same period totaled \$421,000 resulting in a fire loss rate of 0.08 cents per \$100 property valuation -- about half of the fiscal year 1979 rate. The nonfire loss rate approximately doubled in fiscal year 1980, 1.04 cents per \$100 property valuation, as a result of the earthquake damage.

A total of 131 million vehicle miles of official vehicular travel during fiscal year 1980 resulted in 768 accidents and \$535,145 in property damages. The loss rates of 5.9 accidents per million vehicle miles and \$4.08 property loss per 1000 miles were higher than for fiscal year 1979.

The 104,986 monitored Department of Energy and Department of Energy contractor employees received a total dose of 9040 rem in calendar year 1979. Both the total dose and the 1748 employees receiving radiation exposures greater than 1 rem in 1979 represent a continuing downward trend from the calendar year 1978 total dose of 9380 rem and the 1826 employees who received radiation exposures greater than 1 rem.

Fifty-nine appraisals were conducted as part of the Assistant Secretary for Environmental Protection, Safety, and Emergency Preparedness' overview responsibilities. The appraisals indicate that generally adequate plans have been developed and effective organizational structures have been established to carry out the Department of Energy's Environmental Protection, Safety, and Health Protection (ES&H) Program. Three areas with the potential for negatively affecting the ES&H Program were noted and require attention:

- Infrequent appraisal and surveillance of contractor ES&H activities
- Staff turnover with accompanying difficulty in filling vacancies with qualified personnel

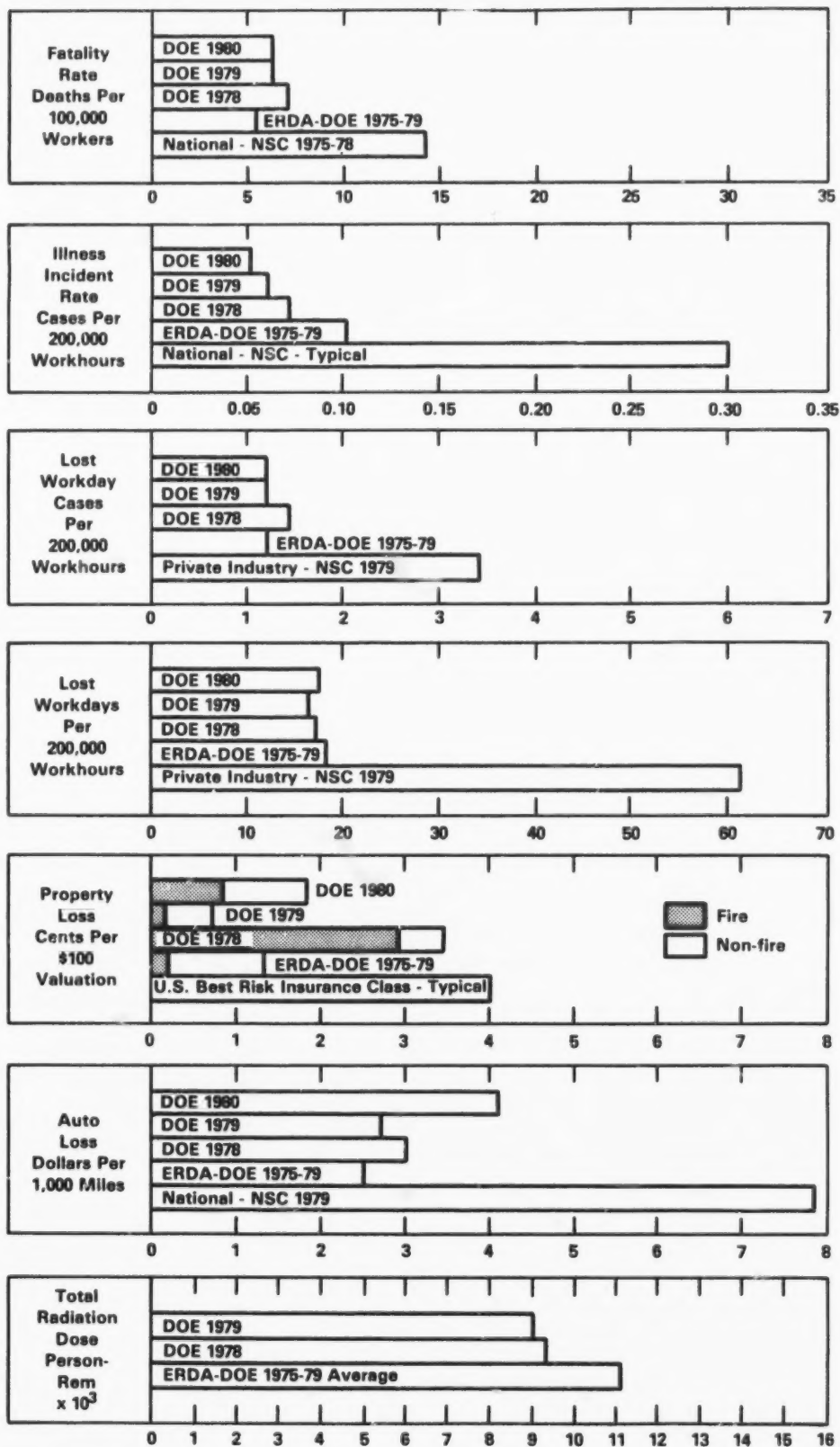
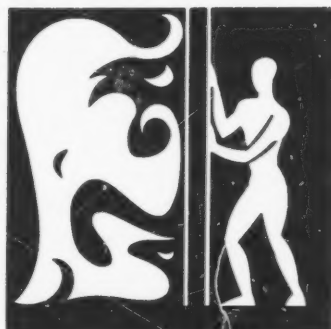


Figure 1. Fiscal Years 1975-1980 Summary Data

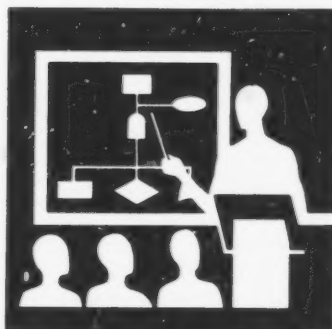
- Increased staff workload without commensurate increases in personnel and funding

More than 300 additional appraisals were made of operating organizations. These appraisals were conducted by personnel independent of the operating organization to ensure that Department of Energy ES&H policies and requirements were being correctly interpreted and implemented by Departmental and contractor organizations and to determine the effectiveness of the local ES&H effort.

A problem in the area of environmental protection is compliance with the provisions of the Resource Conservation and Recovery Act (RCRA) and the Toxic Substances Control Act (TSCA). Regulations issued by the Environmental Protection Agency under RCRA require "cradle-to-grave" control of hazardous wastes, and it is estimated that over \$200 million in construction will be required over the next 5 years to bring Departmental operations into compliance. TSCA regulates the production and commercial use of a number of chemicals. One such chemical regulated by TSCA and of particular concern to the Department of Energy is polychlorinated biphenyls (PCBs). Regulations issued under TSCA require all materials with concentrations of PCBs exceeding mandated limits to be eventually removed from service and destroyed. Estimates of costs for the handling and destruction of PCBs in the Department range between \$25 million and \$100 million.



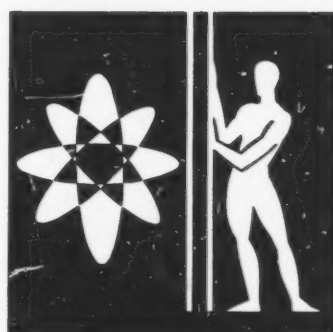
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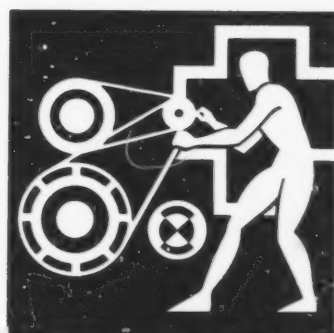
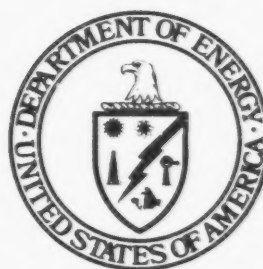
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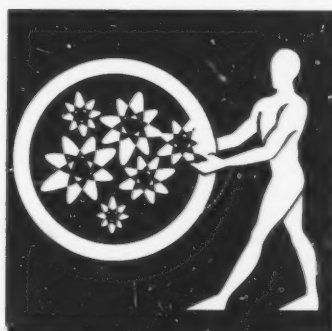
**APPRAISAL
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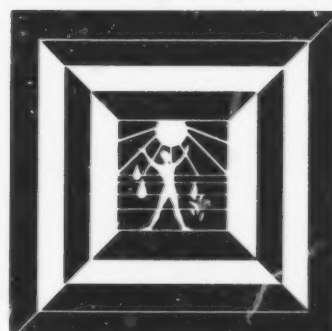
**RADIATION
PROTECTION**



**OCCUPATIONAL
SAFETY & HEALTH**



**EMERGENCY
PREPAREDNESS**



**ENVIRONMENTAL
PROTECTION**

ENVIRONMENTAL PROTECTION, SAFETY, AND HEALTH PROTECTION PROGRAM

Background

The Environmental Protection, Safety, and Health Protection Program is established under the authority of Department of Energy Order DOE 5480.1 "Environmental Protection, Safety, and Health Protection Program for DOE Operations". The program provides, as a matter of Departmental policy, assurance for the protection of the environment, safety and health of the public and employees, and against accidental loss or damage of Government property while complying with applicable statutory requirements affecting Federal facilities and operations. Primary responsibility for program implementation is assigned to the line organizations with independent overview responsibilities assigned to the Assistant Secretary for Environmental Protection, Safety, and Emergency Preparedness. Program requirements and policy established under this Order apply to all Departmental operations and contractor operations where the Department has established contractual control over environmental protection, safety, and health program content.

Basic elements of the Department of Energy's Environmental Protection, Safety, and Health Protection (ES&H) Program include

- Compliance with applicable Federal, state, and local environmental statutes and regulations; among these are the Clean Air Act, Clean Water Act, Endangered Species Act, and the Resource Conservation and Recovery Act
- Compliance with applicable Federal, state, and local occupational safety and health requirements
- Protection of property against accidental loss and damage

The general framework wherein the elements of the ES&H Program are applied to the activities of the Department of Energy includes

- Establishing policy and interpreting requirements levied by the Department of Energy or other agencies through statutory means
- Applying systems safety principles to the Department of Energy activities
- Providing for hazard and risk assessments
- Developing codes, standards, and guides applicable to Department of Energy activities
- Establishing and maintaining an emergency response capability

- Investigating accidents and incidents to determine causes and provide feedback for program improvement
- Conducting environmental monitoring and sampling
- Establishing and conducting applicable employee training
- Conducting audits and appraisals of ES&H Program management and implementation efforts

Responsibilities

ES&H Program implementation is accomplished at three levels. Responsibility for day-to-day program implementation, execution, and assurance that Departmental and Federal environmental protection, safety, and health protection policies, regulations, and requirements are adhered to is vested in the first operating level (e.g., the Department of Energy Federal or contractor organization actually performing the work or task). Program management responsibility is assigned to the second line organization level (e.g., the Department of Energy office responsible for the work or task being performed at the first level) with an independent overview exercised at the third level by the Assistant Secretary for Environmental Protection, Safety, and Emergency Preparedness.

Basic responsibility for implementing the ES&H Program is assigned to the line organizations. This responsibility is met by line officials through Department of Energy delegation of appropriate authorities and responsibilities to subordinate Federal and contractor personnel at field activities; provision of necessary management functions, such as budget support, and periodic appraisals and evaluations of field organizations and programs; and through safety analyses of the Department of Energy operations in accordance with Department of Energy Order DOE 5481.1 "Safety Analysis and Review System."

The Assistant Secretary for Environmental Protection, Safety, and Emergency Preparedness has the responsibility to maintain an independent overview and assessment of Department-controlled activities to ensure that they are conducted in such a manner as to pose no undue risk to the health and safety of the public and employees, Government property, and the environment. These overview functions are carried out through the development of Departmental policies, guides, requirements, and procedures concerning environmental protection, safety, and health protection programs within the Department of Energy operations; provision of technical advice and assistance on ES&H Program elements to line organizations; coordination within the Department of Energy and with other agencies in the development of ES&H standards and requirements; and by ensuring Departmental compliance with the National Environmental Policy Act.

ES&H Program Plans

Individual Environmental Protection, Safety, and Health Protection Program Plans provide the framework for day-to-day ES&H activities at the first operating level. These plans are developed by Federal or contractor employees, as appropriate, and delineate management and implementation procedures and identify required resources. Each plan is both site- and project-specific and may be composed of several individual planning documents, such as Fire Protection, Emergency Action Plans, and Safety Inspection Plans.

Environmental protection efforts at operating facilities regularly focus on compliance with Federal, state, and local environmental standards. Planning for this purpose includes how applicable environmental control and design standards are to be met; the methodology for any monitoring required (including pollutants to be monitored, sampling locations and frequency, methods, data analyses, and data reporting); and a program for followup corrective action. Plans developed for new projects also include planning for National Environmental Policy Act documentation requirements and for ensuring that any mitigating measures identified and committed to in the National Environmental Policy Act documents are complied with.

Safety planning is considered in four separate areas: protection of human life and limb, protection against property loss, compliance with safety requirements, and data collection and reporting. Personnel system safety involves the determination of applicable safety standards, development of a safety implementation plan for the facility, identification of potentially unique hazards, description of enforcement activities, and means for identifying and implementing corrective measures. Property protection begins with adequate consideration of site characteristics (seismicity and flood potential) and includes compliance with building codes and other appropriate standards, an adequate inspection program, and a means for correcting deficiencies. Compliance with system safety requirements includes providing for protection systems and safety features in facilities design; development of a fire protection plan; providing appropriate equipment to carry out the actions described in emergency plans; training of personnel in safety measures; procedures for internal safety review; and accident analysis. Emergency action planning addresses the handling of personnel both onsite and offsite in the event of an emergency; assignment of responsibilities; actions to be taken to minimize personnel injuries, fatalities, or contaminations; reduce property damage or loss; and to protect the environment. Procedures for investigations of and for reporting occupational injuries and fatalities, property loss, and significant program interruptions are important elements of any plan to ensure the gathering of adequate information on which to base future management actions.

Three personnel health program areas are provided for as part of the ES&H Program Plans: occupational medicine, industrial hygiene, and health physics. Elements of these three program areas include examinations, treatment clinics, development of medical emergency plans, worksite visits by medical personnel, monitoring of worksites, and compliance with occupational safety and health standards.

Authorities and Standards

Procedures, standards, and requirements used in the implementation of the ES&H Program are presently embodied in various Department of Energy, Energy Research and Development Administration, and Federal orders, manuals, and regulations. Pertinent elements from these materials are being brought together by the Assistant Secretary for Environmental Protection, Safety, and Emergency Preparedness and incorporated in Order DOE 5480.1 as supplemental chapters:

5480.1 Basic Order	ES&H Program
Chapter I	ES&H Standards
Chapter II	Quality Assurance
Chapter III	Packaging of Fissile Materials
Chapter IV	Criticality Safety
Chapter V	Nuclear Facility Safety
Chapter VI	Reactor Safety
Chapter VII	Fire Protection
Chapter VIII	Contractor Occupational Medical Program
Chapter IX	Construction Safety
Chapter X	Industrial Hygiene
Chapter XI	Radiation Protection
Chapter XII	Prevention, Control, and Abatement of Environmental Pollution
Chapter XIII	Aviation Safety

These chapters contain many of the standards, criteria, requirements, and procedures pertaining to the Department's ES&H Program. Orders covering other aspects of the Department's Environmental Protection, Safety, and Health Protection Program are

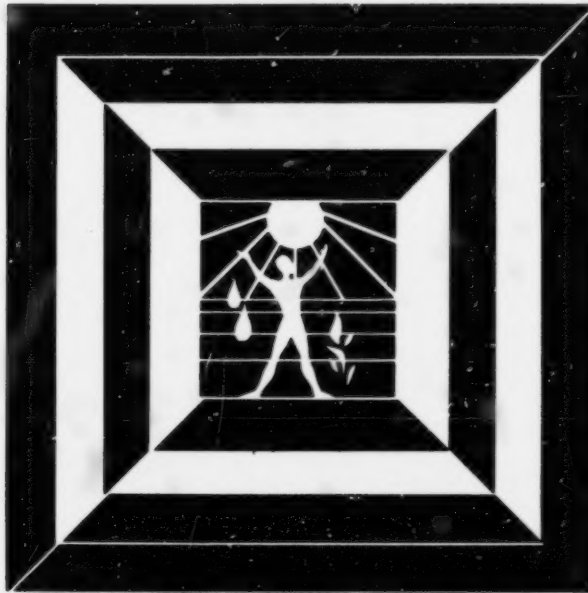
DOE 5481.1	Safety Analysis and Review System
DOE 5482.1	Environmental, Safety, and Health Appraisal Program
DOE 5483.1	Occupational Safety and Health Program for Government-Owned Contractor-Operated facilities
DOE 5484.1	Environmental Protection, Safety, and Health Protection Reporting Requirements
DOE 3790.1	Occupational Safety and Health Program for Federal Employees

Departmental operations are subject to periodic risk analysis, program reviews, and, when necessary, accident investigations as a means of determining whether risks to personnel and property are being maintained at acceptably low levels. The results of these activities provide the means to continually evaluate, improve, and supplement existing ES&H policies, standards, guides, requirements, and procedures.

Order DOE 5481.1, Safety Analysis and Review System, establishes uniform requirements for the preparation and review of safety analyses for Department of Energy operations to ensure that hazards are systematically identified; that their potential impacts are understood; that reasonable measures are taken to eliminate, control, or mitigate any hazards identified; and that management authorization of the operation is documented. The Safety Analysis and Review System is a vital part of the effort expended by the Department in ensuring that management authorization for the design, construction, and conduct of operations is based on an understanding of the associated risks. Additional discussion of the Safety Analysis and Review System may be found on pages 19, 20, and 21.

During fiscal year 1980, the Operational and Environmental Safety Division developed policy documents (DOE Orders) in 6 different areas, completed guidance material covering 16 subjects, and prepared reports on 5 other subjects as part of the Assistant Secretary for Environmental Protection, Safety, and Emergency Preparedness' responsibilities under Order DOE 5480.1. One example, in addition to the supplemental chapters to Order DOE 5480.1 referred to earlier, includes a general environmental safety and health document developed to enable line organizations and their contractors to conform to new and existing Federal and Departmental ES&H requirements. A second example is a set of guidelines for hoisting and rigging safety.

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**ENVIRONMENTAL
PROTECTION**

ENVIRONMENTAL PROTECTION

The Environmental Protection Program within the Department of Energy has three parts:

- Pollution Prevention, Control, and Abatement
- Environmental Monitoring
- NEPA Compliance and Followup

Together they present an integrated approach to meeting the Department of Energy's responsibility to comply with applicable Federal, state, and local statutes relating to environmental protection; to protect and enhance environmental quality and ensure public health and safety as required by the Department of Energy Organization Act; and to implement the provisions of Executive Order 12088 requiring the Department to bring all facilities into compliance with applicable standards.

The Department's pollution prevention, control, and abatement activities are directed toward minimizing the impact of operational units through upgrading of facilities to meet environmental, radiation, and health standards. Monitoring provides the means for both ensuring that installed abatement equipment and systems are operated in compliance with standards and for determining the impact of Departmental activities on the surrounding environment. National Environmental Policy Act (NEPA) compliance is concerned with new programs or projects and activities and is directed toward better decisionmaking with respect to use of the human and natural environments. The NEPA process identifies impacts of the proposal, considers alternatives that may be less damaging to the environment, provides for control and abatement of pollutants, and may specify certain monitoring requirements to ensure that prognoses advanced during the NEPA process are valid. NEPA followup ensures that commitments made in NEPA and other ES&H documents concerning protection of the public and the environment are honored during the design, construction, operation, and decommissioning phases of a project.

Pollution Prevention, Control, and Abatement

The Department of Energy's Pollution Prevention, Control, and Abatement Program is designed to bring all facilities into compliance with applicable environmental standards on air and water quality, noise control, solid waste management, radioactive materials, and pesticides as mandated by Executive Order 12088. Facilities, by definition, include buildings, installations, structures, lands, public works, equipment, aircraft, vessels, and other vehicles and property owned by, constructed, or manufactured for the Department of Energy.

Department requirements, assignment of responsibilities and delegation of authorities for prevention, and control and abatement of environmental pollution are contained in Chapter XII of Order DOE 5480.1. Chapter XII implements the provisions of Executive Order 12088 and applicable portions of Office of Management and Budget Circular No. A-106, "Reporting Requirements in Connection with the Prevention, Control, and Abatement of Environmental Pollution at Existing Federal Facilities."

Performance of design, development, construction, operation, surveillance, and maintenance of the Department of Energy facilities, together with the requirement to identify areas in Departmental operations where facility upgrading is required, is the responsibility of the line organizations. The Director, Operational and Environmental Safety Division, is responsible for the collection and evaluation of information concerning the effects of Departmental operations on the environment. The Director also shares joint responsibility with the line program personnel for preparation and submission of Department of Energy pollution abatement plans and reports to the Office of Management and Budget and the Environmental Protection Agency in accordance with OMB Circular A-106.

At the end of fiscal year 1980, the Department's pollution abatement plan contained 6 projects for air pollution abatement, 17 for water, 4 for noise, and 2 for solid waste. Table 1 provides a listing of active pollution abatement projects for fiscal year 1980. There were an additional 14 projects on the inactive list.

These projects do not address all of the problems now facing the Department with respect to complying with the regulations issued by the Environmental Protection Agency under the Resource Conservation and Recovery Act (RCRA) and the Toxic Substances Control Act (TSCA). The RCRA mandates a "cradle-to-grave" regulatory approach for management of hazardous materials including transportation, handling, treatment, storage, and disposal. The Department currently generates some 400 million pounds annually of nonnuclear hazardous wastes. An additional 770 million pounds of commingled hazardous wastes and nuclear materials are produced annually. Neither RCRA nor TSCA regulate wastes generated in activities conducted pursuant to the Atomic Energy Act and handling of these mixed wastes is the subject of discussions between the Environmental Protection Agency and the Department. It is estimated that expenditures to comply with the intent of RCRA will exceed \$50 million in operating costs and over \$200 million in construction costs over the next 5 years.

The major problem facing the Department with respect to compliance with TSCA concerns polychlorinated biphenyls (PCBs). PCBs are used in transformers, capacitors, hydraulic systems, heat transfer systems, and a number of other areas throughout the Department. Inventories of PCBs are estimated at 25 to 30 million pounds with an estimated cost for handling and disposal ranging between \$25 million and \$100 million. There are several Departmental impacts resulting from the regulation of

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Table 1. Fiscal Year 1980 Pollution Abatement Projects

Facility	Location	Project
Argonne National Laboratory	Argonne, Illinois	Sewage Plant Chlorination
Bonneville Power Administration	Portland, Oregon	Substation Sound Abatement Mineral Oil Spill Prevention Program
Bonneville Power Administration	Vancouver, Washington	Disposal of PCB Capacitors
Feed Material Production Center	Fernald, Ohio	Solid-Liquid Waste Incinerator
Hanford Reservation	Richland, Washington	Improve NO _x Reduction
McLaughlin Substation	McLaughlin, Oregon	Noise Abatement
Oak Ridge Gaseous Diffusion Plant	Oak Ridge, Tennessee	Control of Gaseous Effluents Upgrade Sewage Treatment Plant
Paducah Gaseous Diffusion Plant	Paducah, Kentucky	Emission Control Control of Gaseous Effluents Control of Water Effluents Diking for 22 Bulk Storage Tanks Collection of Hexavalent Chromium Windage
Portsmouth Gaseous Diffusion Plant	Piketon, Ohio	NO _x Recovery Increase Sludge Lagoon Capacity Hazardous Waste Landfill Activated Carbon Column to Remove Organics Construct Containment Pond for Oil and Chlorine Coal Pile Runoff Treatment Increase Sludge Lagoon Capacity for Treatment of Chromium Sludge Treatment of X-700 Effluents Treatment of Electrolyte Cleaning Facility Effluents to Remove Fluorides
Savannah River Plant	Aiken, South Carolina	Temporary Hazardous Storage Facility Enlarge Spray Irrigation Field NPDES Permit Requirements Chlorinator House Process Sewer Modification TNX Retention

PCBs: (1) program interruption; (2) costs associated with removal, packaging, and storage; (3) disposal costs; (4) replacement with suitable substitutes; and (5) potential health impacts. Current regulations require that all materials with PCBs in concentrations above 50 parts per million be removed from service and disposed of -- preferably in a licensed incinerator because incineration is the only proven method of destruction. There were no licensed incineration operations for PCB disposal in fiscal year 1980; therefore, field installations were required to store the material until some approved method of disposal is designated.

Fiscal year 1980 activities directed toward compliance with RCRA and TSCA include development of an inventory of hazardous materials located at each facility; submission of permit applications for hazardous storage, treatment, and disposal facilities; and commencement of preparation of a Department of Energy Hazardous Waste Management Program Plan by the Operational and Environmental Safety Division.

Environmental Monitoring

The Department of Energy's environmental monitoring program requirements are specified in Department of Energy Order DOE 5484.1, "Environmental Protection, Safety, and Health Protection Information Reporting Requirements," and were originally contained in the Atomic Energy Commission Manual, Chapter 0513. Two types of monitoring are required for Departmental operations: environmental monitoring and effluent monitoring.

Environmental monitoring efforts are directed toward ensuring compliance with requirements established in Department of Energy Order DOE 5480.1, determining background levels of radioactivity or other pollutants of concern, and complying with Federal, state, and local environmental regulations. An environmental survey is conducted by the Department of Energy 1 or 2 years prior to the startup of operations at a new site or facility to determine background levels of radioactivity, other suspected pollutants, and noise to use as baselines once operations commence. Pertinent environmental parameters are characterized, and potential pathways for human exposure and environmental impact are identified. These then become two of the several factors used in developing the monitoring plan for the operational site.

Monitoring at operational sites is site specific and involves the collection and analysis of samples from discharge conduits, air, water, soil, foodstuff, and biosphere. It is aimed at determining whether containment and control of releases of radioactivity are functioning as planned, to what extent pollutants released from Department of Energy sites comply with standards, and the impact of Department of Energy operations on the environment.

Effluents are monitored to determine compliance with Department of Energy Order DOE 5480.1, to determine effectiveness of treatment and control, for inventory of radioactivity releases, and to ensure compliance with non-Department of Energy imposed effluent limits or limits committed to in environmental impact statements or other official documents.

Specific monitoring for an individual activity or location may be required by a number of authorities. For example, Chapters I, XI, and XII of Department of Energy Order DOE 5480.1 impose requirements for radiation-related monitoring. Federal or state permits issued under the Clean Air Act, Clean Water Act, etc., generally require monitoring by the applicant to ensure that the conditions of the permit are complied with. Monitoring may also be required in new facilities in accordance with any monitoring and mitigation plan developed pursuant to the Council on Environmental Quality regulations (40 CFR Parts 1500-1508).

Responsibility for implementing and conducting the necessary radiological and/or environmental monitoring rests with line management with program overview exercised by the Assistant Secretary for Environmental Protection, Safety, and Emergency Preparedness through the Operational and Environmental Safety Division.

At present, there are 26 major Department of Energy facilities (Table 2) engaged in environmental monitoring and reporting activities. Each facility prepares and submits an annual report summarizing the results of its monitoring effort and providing an interpretation of the levels of the pollutants by comparing them to applicable standards and baseline data.

NEPA Compliance and Followup

The National Environmental Policy Act (NEPA) places certain requirements on Federal activities that must be complied with except where compliance would be inconsistent with other statutory requirements. Each Federal agency or department is required to interpret the provisions of the Act as a supplement to its existing authority and as a mandate to view traditional policies and missions in the light of the Act's national environmental objectives.

Department of Energy Order DOE 5440.1A, "Implementation of the National Environmental Policy Act," establishes Departmental policy and objectives and assigns responsibilities for the implementation of NEPA. The Department is committed to complying fully with the spirit and letter of NEPA and to ensuring fulfillment of similar statutory environmental responsibilities embodied in the Department of Energy Organization Act. In general, responsibility for integrating the procedural requirements of NEPA with other planning and environmental review procedures required by law, preparing necessary environmental documents, and implementing the proposal rests with the program

Table 2. Department of Energy Facilities Conducting
Environmental Monitoring

Annual Environmental Surveillance Reports

Albuquerque Office

Los Alamos National Scientific
Laboratory, Los Alamos,
New Mexico
Mound Laboratory,
Miamisburg, Ohio
Pantex Plant,
Amarillo, Texas
Pinellas Plant,
St. Petersburg, Florida
Rocky Flats Plant,
Golden, Colorado
Sandia National Laboratories,
Albuquerque, New Mexico
Livermore, California

Chicago Office

Ames Laboratory (Iowa State
University), Ames, Iowa
Argonne National Laboratory,
Argonne, Illinois
Battelle Memorial Institute,
Columbus, Ohio
Brookhaven National Laboratory,
Upton, New York
Fermi National Accelerator
Laboratory, Batavia, Illinois

Idaho Office

Idaho National Engineering
Laboratory, Idaho Falls, Idaho

Nevada Office

Nevada Test Site,
Mercury, Nevada

Oak Ridge Office

Feed Material Research Center,
Fernald, Ohio
Oak Ridge Site,
Oak Ridge, Tennessee
Paducah Plant,
Paducah, Kentucky
Portsmouth Plant,
Piketon, Ohio

Pittsburgh Naval Reactors Office

Bettis Atomic Power Laboratory,
West Mifflin, Pennsylvania
Shippingport Atomic Power Station
Shippingport, Pennsylvania

Richland Office

Hanford Site,
Richland, Washington

San Francisco Office

Energy Systems Group,
Canoga Park, New York
Lawrence Berkeley National
Laboratory, Berkeley, California
Lawrence Livermore National
Laboratory, Livermore,
California
Stanford Linear Accelerator
Center, Palo Alto, California

Savannah River Office

Savannah River Plant,
Aiken, South Carolina

Schenectady Naval Reactors Office

Knolls Atomic Power Laboratory,
Schenectady, New York

managers. The Assistant Secretary for Environmental Protection, Safety, and Emergency Preparedness, determines, after consultation with the General Counsel whether, and at what level, environmental documentation is required and exercises quality control over the documents prepared. The Assistant Secretary also evaluates alternate mitigating measures and provides recommendations and exercises approval or disapproval authority for publication of NEPA documents based upon their content and conformity to applicable authorities after consultation with the General Counsel. Overview responsibility for implementation of the project with respect to environmental considerations as described in the NEPA documents, including any mitigation and monitoring requirements, is maintained by the Assistant Secretary for Environmental Protection, Safety, and Emergency Preparedness. Responsibility for procedural compliance and document quality is generally exercised by the NEPA Affairs Division. The Operational and Environmental Safety Division, through its environmental protection appraisal program, has the overview responsibility to ensure that the environmental commitments made are complied with. To assist in this phase, the Operational and Environmental Safety Division is developing a data system that will identify commitments resulting from the Department's Environmental Impact Statements and the Safety Analysis Review System and track them through the various phases of a project's existence.

All Federal actions having the potential to significantly affect the environment are subject to the procedural requirements of NEPA. Regulations governing the implementation of NEPA have been developed by the Council on Environmental Quality and published at Title 40 Code of Federal Regulations Parts 1500-1508. These have been supplemented by Department of Energy Guidelines for Compliance with the National Environmental Policy Act (Volume 45, Federal Register, page 20694).

Procedures

The general procedures published in the Department of Energy NEPA guidelines require a program office to identify and evaluate environmental factors and appropriate alternative courses of action and determine the appropriate environmental review document required at the earliest possible time in the decisionmaking process. Document preparation should be commenced as close as possible to the time that the Department begins development of or is presented with a proposal and completed in advance of final decisionmaking (in most instances this will be at the "go/no go" decision point). Other Departmental planning and decisionmaking documents are reviewed to ensure that alternatives to be considered by the decisionmakers are encompassed by the range of alternatives in the document under preparation. The environmental documents, or summaries, are circulated within the Department along with the proposal and other decisionmaking documents to ensure that Department of Energy officials use the environmental documents and consider the alternatives represented.

Applicants for a Department of Energy lease, license, certificate, financial assistance, allocation, exemption, or other similar action are

expected to consult with the Department as early in their planning process as possible to ascertain what environmentally related information must be submitted and then conduct any studies deemed appropriate by the Department to determine the environmental impact of the proposed action. Applicants are also required to consult with appropriate Federal, state, local agencies, and other interested parties to ensure that environmental concerns are properly identified and to notify the Department of other actions required for project completion so that the Department of Energy can effect coordination with the environmental review.

In addition to the Guidelines for Compliance with the National Environmental Policy Act, the NEPA Affairs Division, Office of Environmental Compliance and Overview, has developed an "Environmental Compliance Guide" Document No. DOE/EV/0132, to assist Department of Energy personnel by providing information on the process and requirements of the National Environmental Policy Act, other environmental statutes that bear on the process, and the time relationships involved.



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OCCUPATIONAL SAFETY AND HEALTH

The Department of Energy's Occupational Safety and Health Program is comprised of six basic elements:

- Early identification of hazards through analyses of technology, programs, and facilities
- Implementation of mitigating actions and installation of controls wherever possible
- Establishment, promulgation, and enforcement of strict standards for design, construction, and operation of facilities
- Development and implementation of vigorous inspection programs with follow-up corrective action as required
- Development and utilization of thorough training programs
- Establishment of a comprehensive occupational medical program

Safety and health programs at Department of Energy facilities have evolved in response to Departmental policy requiring all operations to be conducted in a manner that limits risks to health and safety of the public and employees, and provides adequate protection to property and the environment.

Identification and Control of Hazards

Responsibility for occupational safety and health programs rests primarily with the line organization and implementation begins during the earliest phases of a project. An invaluable tool for ensuring that Departmental operations are designed, constructed, and conducted in the safest and least harmful manner is the use of the Safety Analysis and Review System. Although the safety analysis has wider application, one of the primary requirements is to demonstrate that the proposed operation can be conducted in a manner that will limit risks to the health and safety of the public and employees and adequately protect property and the environment. Department of Energy Order DOE 5481.1, "Safety Analysis and Review System," requires the preparation of a safety analysis to identify potential hazards, analyze their potential impacts, and develop reasonable measures to eliminate, control, or mitigate the hazards. Only three types of operations are excluded from safety analysis:

- Activities exclusively relating to construction
- Activities involving nuclear safety, packaging, and transporting of nuclear materials, which are covered by other Department directives

- Activities presenting only hazards that are routinely encountered and accepted in the course of everyday living by the public

The Safety Analysis and Review System is initiated during the earliest phases of the life cycle of the program or facility by the operating organization. It provides a framework in which environmental, safety, and health issues can be evaluated in a fashion tailored to program needs; ensures that Departmental standards are incorporated in all phases of the program from design to decommissioning; defines environmental, safety, and health criteria unique to a given program; and provides much of the basic background data upon which the site-specific ES&H Program is built (e.g., fire protection requirements, industrial hygiene, and occupational health requirements). In complex or expensive operations, the safety analysis may be performed in two parts: (1) a preliminary analysis prior to the start of substantial construction so that potential problems may be eliminated or mitigated in the most cost-effective manner and (2) a final analysis prior to initial operation. For certain Departmental programs, an analysis of safety and pollution factors must be prepared as part of the preliminary proposal before authorization to initiate definitive design work can be granted. In some instances, the requirements levied by Order DOE 5481.1 can be met at this time.

A safety analysis provides a description of the project site and evaluates its characteristics with respect to flood potential, seismicity, wind damage, etc.; addresses design criteria for systems, components, and structures; describes normal and emergency operating procedures; identifies hazards; predicts consequences of hazards and probability of occurrence; describes design features and administrative controls provided to prevent or mitigate potential accidents; discusses potential accidents; and defines operational limitations.

The first step in the safety analysis is to identify hazards not routinely encountered and accepted by the public. These are generally categorized by energy sources: potential energy (pressure, electrical, nuclear, etc.), kinetic energy (moving vehicles, conveyor belts, and operating machinery), and chemical (corrosive, explosive, flammable, etc.). Systems operations are then reviewed to gather information about hazards, operational events that may trigger impacts, and controls that may be used. Further analysis defines potential impacts in terms of severity, exposure, and likelihood of occurrence. Once hazards have been defined, the potential for impact estimated, and events that require control identified, a rational selection can be made from among control and mitigation options. In general, the system design and the safety analysis are performed concurrently, because the analyses will be sensitive to design details. Where the safety analysis identifies a need for change, the design is modified. Design and safety analysis then become iterative.

Most operations change with time, requiring a periodic review, and in some instances, an update, of the safety analysis. This may occur when

- A hazard that is new or significant has been added to the operation
- Site characteristics have changed significantly
- Existing controls have been changed or deleted
- Critical personnel have changed
- The facility has been modified
- The nature of the operation has changed.

A major element in occupational safety is the establishment, promulgation, and enforcement of applicable minimum standards to be followed during design, construction, operation, modification, or decommissioning. These may be Federal, state, or local standards that apply or may be Departmental standards developed as a result of safety analyses performed for a given operation. Standards applicable to Departmental facilities are promulgated in Chapter I of Order DOE 5480.1 and are applicable to Department of Energy activities and to those of contractors. Examples of standards that must be complied with are facilities design criteria, ANSI Standards for Safety, Occupational Safety and Health Standards, Construction Safety, Drilling Safety, Electrical Safety, Mine and Tunnel Safety, and Nuclear Safety. In addition to required standards, broader coverage is provided through the promulgation of recommended standards, such as Standard Methods for the Examination of Water and Wastewater, and the Handbook of Fire Protection.

The Safety Analysis and Review System requirements also complement the National Environmental Policy Act (NEPA) process and provide additional assurance that NEPA design commitments are kept. The Safety Analysis together with the NEPA documents, constitute a vital part of the decision-making package used in determining whether to authorize construction, operation, significant modification, or decommissioning of a project or facility.

Industrial Hygiene

To protect employees' health and well-being, the Department has established an aggressive industrial hygiene program designed to identify potential health hazards, evaluate the degree of hazard, establish acceptable limits of exposure, and institute appropriate control measures. Occupational stresses and potential health hazards of concern include chemical (liquid, particulate, vapor, and gas), physical

(nonionizing radiation, noise, vibration, magnetic fields, and extremes of temperature and pressure), biological (agents of infectious disease), and ergonomic (body position in relation to work, repetitive motion, and mental or physical fatigue).

Potential occupational health hazards in an operating facility may be identified by an industrial hygienist through a knowledge of facility operations, periodic walk-through surveys, information provided by employees and the review of proposed projects and facilities. An Industrial Hygiene Task Force at Los Alamos National Laboratory also provides the Department of Energy with access to experts in industrial hygiene, analytical chemistry, toxicology, engineering, and other related fields when needed. Their services can be requested by field and contractor industrial hygienists to evaluate new and especially complex operations or to supplement facility industrial hygiene resources by providing specialists or additional manpower for special studies.

Additional support for the Department's occupational health program is provided by the Toxic Material Advisory Program at Brookhaven National Laboratory, Upton, New York. This group obtains published health effects data and interprets them in light of Department of Energy operations. This information is then used to evaluate and control occupational health hazards and to develop standards and guidelines.

Whenever a new process or facility is being planned, or whenever an existing process is being considered for change or modification, the operating or engineering organization notifies the industrial hygiene organization to allow the proposed changes to be evaluated while still in the planning stages. When potential health hazards are identified, the industrial hygienist evaluates the extent of the hazard. If the potential hazard is judged sufficient to produce illness or injury, the hygienist recommends control measures to be employed, periodically reports to management regarding the adequacy of controls, and any need for additional controls or other measures.

Operational Inspections and Monitoring

Safety and property inspection plans provide the means for ensuring that hazardous conditions will be identified or detected as they develop. Department of Energy Order DOE 5483.1, "Occupational Safety and Health Programs for Government-Owned Contractor-Operated Facilities," requires contractors to periodically inspect work sites to ensure that facilities are in compliance with Departmental standards. Department of Energy second line organization level occupational safety and health personnel conduct both announced and unannounced compliance inspections of all government-owned contractor-operated facilities as part of their management responsibilities. Inspections may also be conducted by Occupational Safety and Health Administration and National Institute of Occupational Safety and Health representatives. Willful violations of safety and health standards by the contractors, or refusal or failure to correct violations of Department of Energy safety and health standards may be justification for contract termination.

Regular monitoring of working spaces for known toxic substances and harmful physical agents used or produced at a particular facility even where control measures have been imposed (where operations or conditions warrant) is required by Departmental Orders DOE 5483.1 and 5480.1, Chapter X. The facility, staff, or consultant industrial hygienist determines the type and frequency of monitoring and reports to management regarding the adequacy of controls, need for additional controls, or recommendations for maintenance. Departmental regulations require that monitoring results be documented in a manner that can be audited, compared with applicable standards, and that can be associated with an individual, a particular job station, or a job description. At any time, the information gathered as part of the monitoring program indicates that an employee may have been exposed to toxic material or other harmful agents in excess of Departmental standards, he or she must be promptly notified.

Occupational Medicine

Early detection, treatment, and rehabilitation of ill or injured employees is a vital part of the Occupational Safety and Health Program of the Department of Energy. Minimum medical program requirements are defined in Department of Energy Order DOE 5480.1, Chapter VIII, "Contractor Occupational Medical Program," and provide for maintenance of a healthful work environment, employee health examinations, diagnosis and treatment of injury or disease, preventative medicine programs, and medical emergency and disaster preparedness. This is accomplished through the establishment of a comprehensive Occupational Medical Program staffed by professional medical personnel with special knowledge of health protection, health maintenance, job hazards, job stresses, and work environment hazards of employees.

Occupational medical personnel periodically visit worksites and facilities to familiarize themselves with worksite environments; materials, processes, and procedures used; and any physical, chemical, or biological hazards that employees might be exposed to. These visits by occupational medical personnel may be coordinated with industrial hygiene, health physics, toxicology, safety, or paramedical personnel, and the knowledge gained may be used to form the basis for corrective action or preventive measures recommended to management where hazards have been identified. Management must also furnish appropriate occupational medicine personnel with full and timely information on new processes, and new physical, chemical, or biological agents introduced onto the worksite. Participation in new materials and processes, review committees and safety committees also enables medical personnel to provide better diagnosis and treatment for work-related illnesses and injuries and to strengthen health maintenance efforts.

Preplacement physical examinations of new employees followed by periodic examinations enable the Department to (1) determine the health status and physical fitness of new employees to aid in job placement so

that the individual can perform all required functions without undue hazard to the individual, other employees, or facilities; (2) detect any evidence of illness or injury and determine whether there is an occupational relationship; and (3) ensure that the employees' health and fitness remain compatible with the positions assigned. Return to work health examinations are provided to employees with occupationally related injuries or illnesses to determine whether the employee may return to work without undue hazard or accident risk to the individual or others. Special health examinations are also provided for employees subject to especially stressful work environments or subject to exposure to especially hazardous agents as a means of monitoring their health.

Occupational Injury and Illness

When serious accidents or incidents do occur involving Department of Energy controlled activities, investigations are conducted in accordance with the criteria described in Appendix A. During fiscal year 1980, 33 occurrences were initially identified as meeting the criteria established by the Department for formal investigations. Appendix B provides a summary of accident investigations conducted for fiscal year 1980.

Accidents and incidents not requiring formal investigations are reported and investigated in accordance with Chapter IV, Order DOE 5484.1, "Environmental Protection, Safety, and Health Protection Information Reporting Requirements." In general, Department of Labor, Occupational Safety and Health Administration (OSHA) rules govern the recording and measuring of work injury experiences. A case is considered occupational if it arises from employment-related causes. Recordable cases include all occupational deaths and illnesses and those injuries that result in or require

- Medical treatment other than first aid
- Loss of consciousness
- Restriction of work or motion
- Transfer to another job or termination of employment

Cases are recorded in a log kept at each reporting unit and include fatalities, lost workday cases, and nonfatal cases without lost workdays. These cases are defined as follows:

Fatality:

- Any death caused by an occupational illness or injury, regardless of the elapsed time between the injury and death or the duration of the illness

Lost Workday Case(s):

- Injured or ill employee misses one or more full days of work

- Injured or ill employee is restricted from performing all of the assigned duties of his job for one or more full days at the workplace, regardless of whether those duties are required during the restriction

Nonfatal Case Without a Lost Workday(s):

- All other cases

Transfer of an employee to another job or termination of employment because of occupational injury or illness is also indicated in the log. All recordable cases are reviewed, and efforts are initiated to correct conditions causing the injury or illness.

Fiscal Year 1980 Fatalities, Injuries, and Illnesses

Ten occupational-related fatalities associated with Department of Energy Federal or contractor personnel occurred during fiscal year 1980 for a fatality rate of 6.7 deaths per 100,000 workers. This compares to the fatality rate of 14 deaths per 100,000 workers for United States industry in 1979.

Employee fatal accidents are grouped by cause in Table 3. Four of the ten fatalities occurred in crashes of aircraft and three others were related to falls.

Table 3. Fatal Accidents During Fiscal Year 1980

Cause	Number of Accidents	Number of Fatalities
Aircraft	2	4
Falls	3	3
Automobile	2	2
Cardiac Event	<u>1</u>	<u>1</u>
Total	8	10

The aircraft involved in the fatal accidents were a chartered Cessna 182 airplane and a Hughes 500C helicopter. Three employees of the Lawrence Livermore National Laboratory returning from a business trip died on November 16, 1979. The Cessna airplane, piloted by one

of the Lawrence Livermore employees, crashed during severe weather conditions on approach to the Livermore airport. The helicopter, piloted by an employee of EG&G, Washington Aerial Measurements Department, disappeared into Chesapeake Bay during a flight from Andrews Air Force Base on March 24, 1980.

Three deaths were caused by falls. One Department of Energy employee fell while on an official trip. The other two fatalities occurred as a result of falls on construction sites of the Strategic Petroleum Reserve and the Western Area Power Administration.

One automobile fatality occurred in California and one in Arkansas. The tenth fatality was a patrolman who suffered a cardiac event while undergoing a physical fitness test in Richland, Washington.

Occupational Injury

A total of 3350 injuries and illnesses were recorded during fiscal year 1980. Incidence rates for these injuries and illnesses are given in Table 4 for each type of Departmental operation and for United States industry. The Department of Energy incidence rates were approximately one-third the comparable rates for United States industry with less than half (46 percent) of these cases resulting in lost workdays or work restrictions.

Table 4. Fiscal Year 1980 Injury and Illness Incidence Rates

Operation	Number Recordable Cases	Incidence Rate		
		Recordable Cases	Lost Workday Cases	Lost Workdays
Architectural and Engineering	11	1.3	0.4	6.3
Production	662	1.6	0.5	11.7
Government	514	2.7	1.0	19.4
Research	1164	1.9	1.0	13.0
Services	179	2.8	1.6	25.9
Cost Construction	496	5.8	2.4	37.7
Lump Sum Construction	324	11.2	4.7	84.3
All DOE-Reporting Facilities	3350	2.4	1.1	17.2
United States Industry*	--	8.0	3.4	62.0

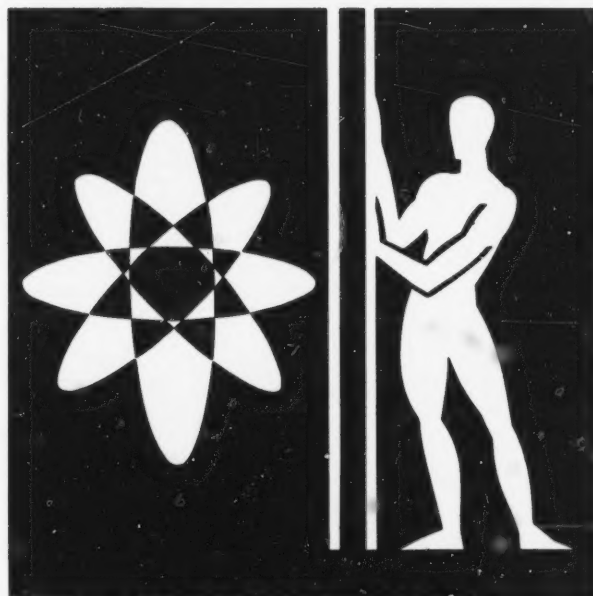
* Reporters to the National Safety Council, Accident Facts, 1980 Edition.

Occupational Illness

Occupational illnesses are acute and chronic illnesses or diseases that may have been caused by inhalation, absorption, ingestion, or direct contact with a harmful substance. A total of 70 cases of occupational illnesses were reported in fiscal year 1980, which represents a decrease from 103 cases reported in fiscal year 1978. These accounted for 2 percent of the 3350 cases reported for all injuries and illnesses. The nature of these cases is shown in Table 5. The greatest number have historically been minor skin irritations that do not result in work restrictions or lost workdays (approximately one-fourth of the reported occupational illness cases resulted in lost workdays).

Table 5. Occupational Illnesses Reported During Fiscal Year 1980

Category	Number of Cases
Skin Diseases or Disorders	40
Disorders Due to Physical Agents	15
Respiratory Conditions Due to Toxic Agents	5
Poisoning (Systemic Effects of Toxic Materials)	5
Dust Diseases of the Lungs	1
Disorders Associated With Repeated Trauma	0
Other Diseases	4
Total	70



**RADIATION
PROTECTION**

RADIATION PROTECTION

The Department of Energy's radiation protection policy, like the earlier policies of the Atomic Energy Commission and the Energy Research and Development Administration, is based on recommendations by the National Council on Radiation Protection and Measurements, the International Commission on Radiation Protection, and the Federal Radiation Council. It is applicable to all Department of Energy and Department of Energy contractor operations not licensed by the Nuclear Regulatory Commission.

The basic Department of Energy policy is to conduct operations in a manner that would limit both cumulative and individual radiation exposures to individuals and population groups to the lowest levels technically and economically practicable. This means that, in addition to maintaining exposures below radiation protection standards, every effort is made to keep exposures as low as reasonable achievable. This is done through proper design considerations of new facilities or modifications to an existing facility or equipment; minimizing errors in radiation exposure assessments through the application of state-of-the-art instrumentation, maintenance, and calibration; and by the use of appropriate procedures and training.

Facilities

Facilities design objectives are to limit onsite personnel exposure levels to less than one-fifth of the permissible dose equivalent limits. Factors considered during design include occupancy time, source terms, spacing, processes, equipment, and shielding. The primary means for ensuring protection is through the use of physical safeguards, e.g., remote handling equipment, shielding, etc., and isolation of high-risk areas through compartmentalization. The general concept in facility design for containment of high-level contaminants is primary, secondary, and tertiary confinement. Primary confinement is the process enclosure, secondary confinement is the operating area, and tertiary confinement is the structure. Facility design also considers means of minimizing contamination buildup and ease of decontamination through avoidance of rough surfaces, cracks and crevices, and defining personnel and equipment traffic patterns to reduce the potential for the spread of contaminants.

Operating Equipment

Equipment and components requiring frequent servicing are located in areas free of radiation or in the lowest practicable radiation field whenever possible. All operating equipment is routinely inspected to ensure optimum safety performance. Equipment located in glove boxes is designed for in-place maintenance, and the glove boxes are designed to permit easy, effective decontamination. Glove boxes are also subject to regularly scheduled inspections and decontamination because contamination buildup is a major source of worker exposure.

Equipment used in the radiation monitoring systems provides both independence and redundancy to protect against system failure and provide maximum safety to employees. The equipment is selected, installed, tested, and calibrated in accordance with American National Standards Institute Standard "Specification and Performance of Onsite Instrumentation for Continuously Monitoring Radioactivity in Effluents."

Procedures and Training

Development of proper procedures to maintain personnel exposures as low as reasonably achievable and then training employees in these procedures is essential to the Department's radiation protection program. Chapter XI, Department of Energy Order DOE 5480.1 establishes exposure limits for employees and provides guidance on limiting exposures under both normal and emergency situations.

In emergency situations, the guiding principle is to minimize risk. Risks taken must be carefully weighed against the benefits to be gained, and sound judgment and flexibility of action are crucial. Therefore, the procedures to be followed and the exposure limits permitted are decided by the official in charge of the emergency operations.

The Department has established rather specific requirements regarding the development of procedures applicable to normal work conditions. When possible, personnel exposures are limited by reducing exposure rates in the work areas rather than rotating personnel. Each location is evaluated routinely to ensure that radiation exposures are maintained as low as reasonably possible. Personnel are required to use special tools and temporary shielding to reduce radiation exposures whenever possible and develop estimates of total man-rem doses for large tasks and individual man-rem doses for a job prior to commencement.

As a minimum, each worker, as applicable, must

- Know the principles of design, operation, and maintenance of the plant, project equipment, or experiment
- Be aware of potential problem areas
- Be familiar with the basic characteristics of radiation and contamination
- Be familiar with the methods (procedures and equipment) for exposure and contamination control
- Have a basic understanding of biological dose and methods of assessment
- Know applicable emergency procedures and systems

Radiation Exposure

Maintaining radiation dose records is an important element of the Radiation Protection Program. Chapter XI of Department of Energy Order DOE 5480.1, "Requirements for Radiation Protection," provides for individual monitoring when the employee has a potential for receiving a dose or dose commitment in any calendar quarter in excess of 10 percent of the quarterly or annual standards. In some instances, monitoring for internal radiation is conducted through the use of bioassay analysis, in vivo counting, or other appropriate means. Thorough and accurate documentation of an employee's radiation dose history is essential for regulating future radiological exposure and protecting the individual's health.

Both Department of Energy Order DOE 5480.1, Chapter XI, and Chapter IV, Departmental Order DOE 5484.1, "Environmental Protection, Safety, and Health Protection Information Reporting Requirements," require that certain radiation-related data be recorded and reported to the Department's System Safety Development Center as a means of evaluating the Radiation Program's effectiveness. Monitoring data include

- Contamination levels recorded at restricted area control points
- Accumulated doses recorded on monitoring devices
- Doses monitored by special devices
- Doses received by visitors

Records are also maintained for the following data:

- Contamination levels in the workplace and in the environment
- Radiation surveys of the workplace and the environment
- Instrument calibration and repair records
- Emergency actions and reports
- Incident and near-miss reports

Annual Radiation Exposure Summary

Radiation exposure data for the Department of Energy's Federal and contractor employees are collected in accordance with accepted practice on a calendar year basis. The latest data available cover calendar year 1979.

The distribution of whole body radiation dose equivalents for the 104,986 Department of Energy and Department of Energy contractor employees monitored during calendar year 1979 is shown in Table 6. The 104,986 employees monitored received a total dose of 9040 rem in calendar year 1979 compared to a total of 9380 rem in calendar year 1978. The number of radiation workers exceeding 1 rem exposure also declined from 1826 employees in 1978 to 1748 employees in 1979. During 1979, both the total dose and the number of individuals in the higher dose ranges continued their general downward trend.

In calendar year 1979, 48 percent of the monitored radiation workers received no measurable occupational dose. The number of monitored employees who received no measurable dose equivalent for calendar years 1975 to 1979 is given in Figure 2.

The effective application of the as low as reasonably achievable principle can be seen in Table 7 and Figure 3, which show the percentage of monitored employees who received a dose greater than 1 rem and greater than 2 rem for the years 1965 to 1979. Only 1.66 percent and 0.44 percent of all workers monitored in calendar year 1979 received a dose greater than 1 rem and 2 rem, respectively. These values represent a threefold reduction since 1965 in the percentage of workers receiving these higher range doses.

Contamination and Overexposure Events

Contamination and over-exposure events, as defined in Order DOE 5484.1 are reported promptly to the Department of Energy's Emergency Operations Center. During fiscal year 1980, there were three instances of personnel contamination and one instance of over-exposure. In one instance, an employee was found to be contaminated with a small amount of plutonium during routine monitoring. The contamination was external and not expected to result in a radiation exposure.

In a second instance, a routine survey at one facility detected a small quantity of promethium 147 on the hands and shoes of a security officer and on the clothing of several other individuals. Surveys also found minor contamination in the security headquarters building and in several vehicles. The amounts detected did not constitute a health hazard to the individuals involved and the building and vehicles were decontaminated. Source of the contamination was a luminous sight on one of the weapons being used in a routine security training exercise.

The third instance of contamination involved an employee engaged in a decommissioning and decontamination effort at a plutonium processing building. The employee discovered two small puncture wounds between the thumb and index finger of the left hand upon removal of his protective clothing. Monitoring of the wound found some contamination. The wounds were excised and no remaining contamination was detected. The employee could not recall how the injury occurred.

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Table 6. Employee Dose Distribution From Calendar Years 1965-1979

Year	Dose Range (rem)														Total Monitored	
	<Meas*	0-1	Meas-1*	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10	10-11	11-12		12
1965		128360		4158	1704	515	294	70	32	26	25	22	6	2		135214
1966		131522		3708	1630	593	313	88	47	24	6	2			1	137932
1967		102510		3472	1572	555	168	35	29	23	17	4	1			108386
1968		103206		2799	1408	425	144	3	1							107988
1969		98625		2554	1313	335	86	4						1		102918
1970		92185		2608	1329	279	158	5	4	2		1				96681
1971		90640		2380	888	275	118	8	3				1		2	94315
1972		88077		2130	828	219	95	8	2							89460
1973		89071		9144	727	172	60	2	1							91977
1974	43184		32500	1867	688	149	40	4								78232
1975	43310		43141	1846	753	232	142				1					88425
1976	40083		47886	1679	475	70	6	1								90200
1977	43017		49948	1579	545	103	23			1	2				2	95220
1978	44898		55296	1323	439	53	11									102020
1979	50003		53235	1286	416	33	10	1				1				104986

*Prior to 1974, the dose ranges of less than measurable (<Meas) and measurable to 1 rem (Meas-1) were not reported separately.

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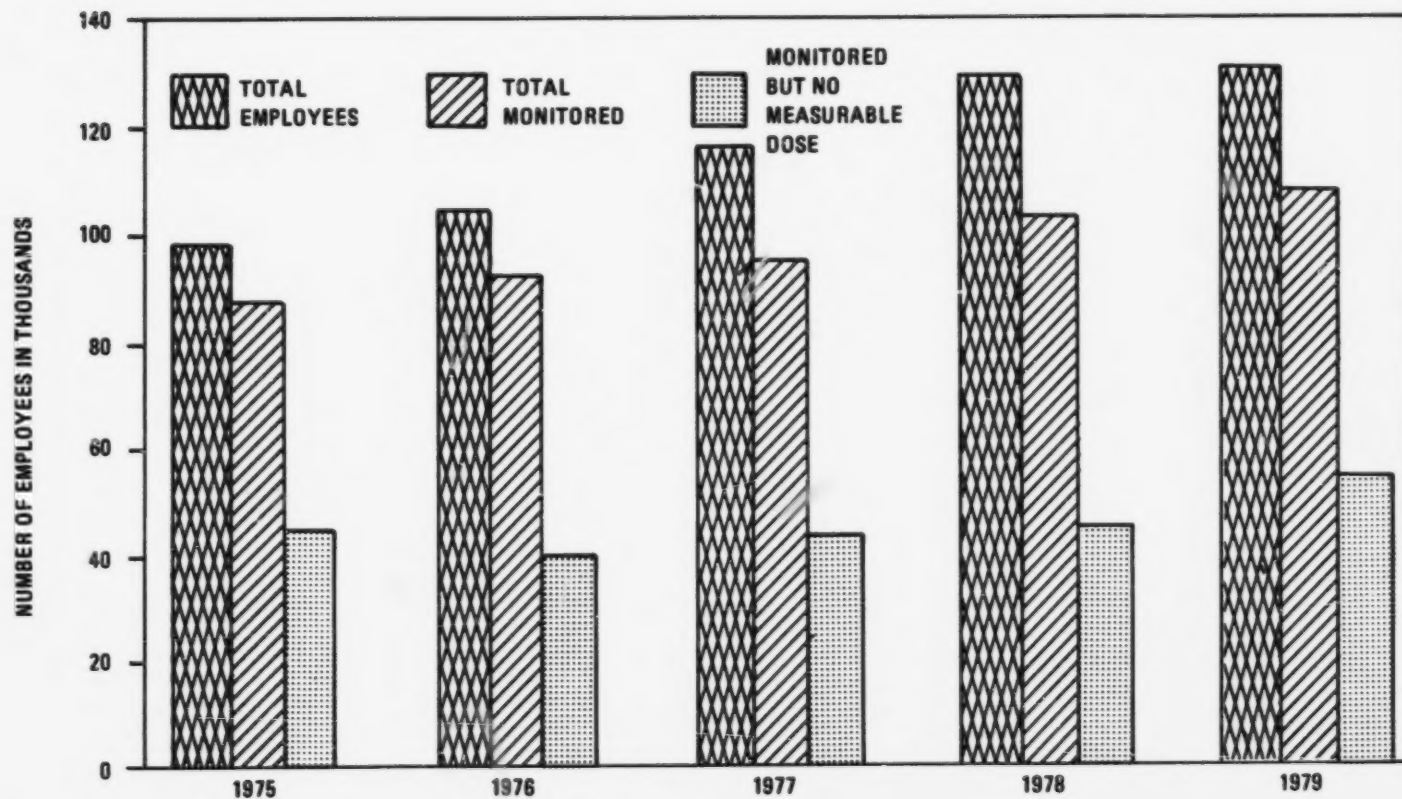


Figure 2. Comparison of Number of Employees, Number of Employees Monitored, and Number of Employees Monitored That Received No Measurable Dose Equivalent

Table 7. Employees Who Received Annual Whole Body Dose Greater Than 1 Rem and Greater Than 2 Rem in Calendar Years 1965-1979

Calendar Year	Number Employees Monitored	Number of Employees With Annual Whole Body Dose Equivalents		Collective Dose Equivalent (Man-rem)*
		>1 rem	>2 rem	
1965	135,214	6,854	2,969	14,918
1966	137,392	6,410	2,704	14,173
1967	108,386	5,876	2,404	12,583
1968	107,986	4,780	1,981	9,877
1969	102,918	4,293	1,739	8,706
1970	96,661	4,476	1,778	9,135
1971	94,315	3,675	1,295	7,357
1972	89,460	3,383	1,253	6,769
1973	91,977	2,906	962	5,623
1974	78,232	2,548	881	4,944
1975	88,425	2,974	1,128	6,111
1976	90,200	2,231	552	3,984
1977	95,220	2,255	676	4,251
1978	102,020	1,826	503	3,317
1979	104,986	1,748	462	3,157

* This table reflects the trend in radiation exposures greater than 1 and 2 rem. The annual collective dose equivalent has been estimated by using the midpoint of each dose range shown in Table 6.

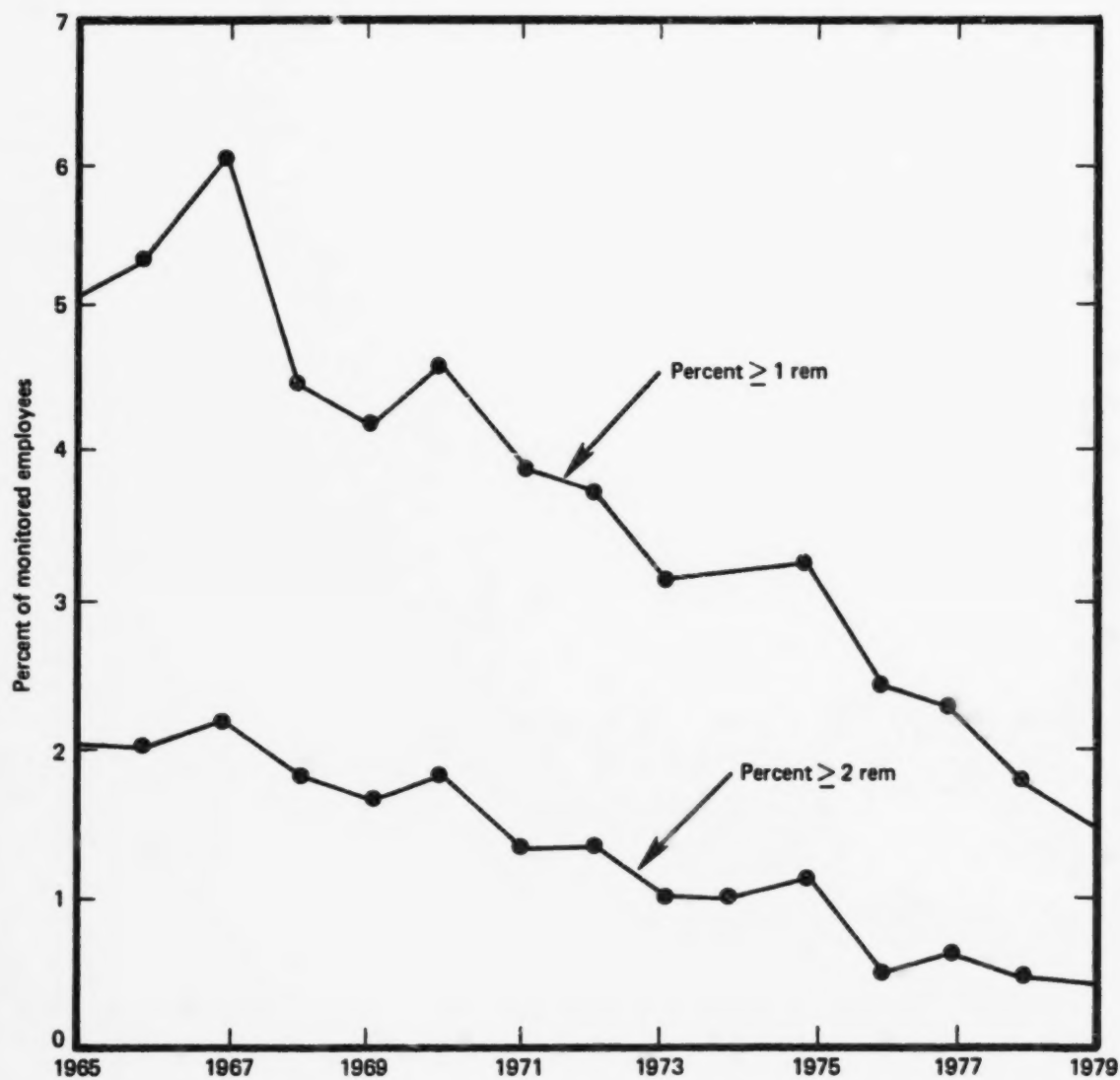
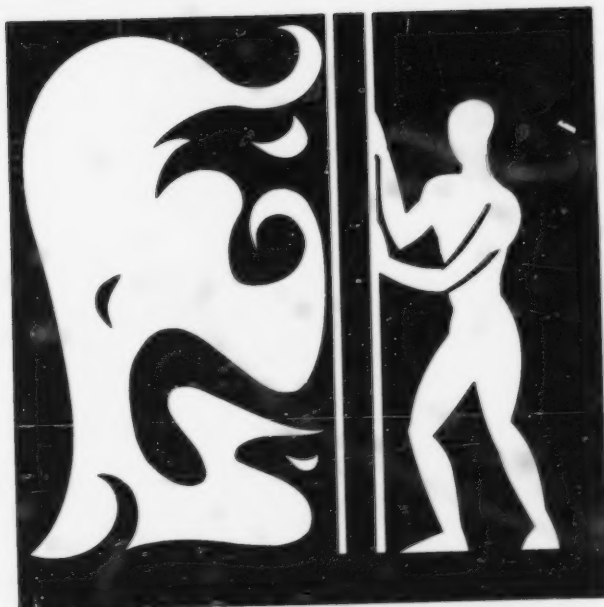


Figure 3. Percentage of Employees With Whole Body Dose Equivalents Greater Than 1 Rem and Greater Than 2 Rem

One instance of overexposure occurred. An employee involved in loading graphite crucibles with uranium metal scrap received a radiation dose of 8.69 rem to the skin of the whole body during the second quarter of fiscal year 1980. The maximum permissible exposure is 3 rem per quarter, and the work has been performed for a number of years with a maximum exposure of 1 rem per quarter. Investigators found no single apparent reason for the high exposure.

During fiscal year 1980, two film badge readings exceeded permissible radiation standards, but did not result in an attributable dose to the employees involved. In the first instance, the film badge, which was not worn by the employee during the period it was issued, was contaminated by being placed on a bookshelf near some high-grade uranium samples. In the second instance, the badge was contaminated by an unknown source; however, a medical and cytogenetic evaluation of the employee indicated that it was improbable that the employee received the 50-rem whole body dose indicated by the badge reading.

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FIRE PROTECTION

FIRE PROTECTION PROGRAM

The Fire Protection Program continues to be one of the most effective of the Department of Energy's safety efforts. Fiscal year 1980 losses were few in number and resulted in minimal damage. Losses totalled \$421,000 during fiscal year 1980, 45 percent less than reported in fiscal year 1979. The fire loss rate fell from 0.15 of a cent per \$100 property valuation in fiscal year 1979 to 0.08 of a cent per \$100 property valuation with the largest single loss occurring when a quonset hut and its contents were destroyed by fire for a total of \$200,000. Twenty-five separate fires accounted for the remaining \$221,100 in property losses. This is a major achievement considering the wide variety of potentially large fire risks in facilities totalling about \$55 billion in estimated replacement value.

The basic objectives of the Department of Energy's fire protection program are that

- No threats to the public health or welfare will result from fire
- There are no undue hazards to employees from fire
- Vital programs will not suffer unacceptable delays as a result of fire
- Property damage will be held to manageable levels

The means for achieving these goals are through elimination or minimization of fire hazards by proper facilities design, construction, and operation. Standards and minimum requirements are set forth in Department of Energy Order DOE 5480.1, "Environmental Protection, Safety, and Health Protection Program for DOE Operations," Chapters I and VII. In general, these requirements apply to all Government-owned or leased property.

Fire prevention is the foremost element in the Department's fire protection efforts and begins in the earliest stages of program or system development. Identification and elimination or minimization of hazards resulting from fires receive major emphasis in the Safety Analysis and Review System. During design, strict standards are applied to provide built-in fire protection. For example, Department of Energy buildings are designed to comply with the intent of the Life Safety Code developed by the National Fire Protection Association. Where applicable, features that limit the spread of fire, such as firewalls, fire doors, and draft barriers are designed into the facilities. Special hazards are protected by isolation, segregation, or the use of special fire control systems (e.g., automatic sprinklers, inert gas flooding, explosion suppression). Means for limiting or controlling damage potentials from fire, hazardous smoke, gases, water runoff, etc., that can reasonably be anticipated are also included during design

and construction. Containment systems to preclude offsite releases of hazardous amounts of toxic materials along with the means for controlling liquid runoffs so that contaminated or polluting liquids will not escape are provided where needed.

Since 1969, the Department of Energy and its predecessor agencies have been conducting major programs for upgrading fire protection at existing facilities because both the largest dollar loss from all types of accidents and the largest individual losses are historically the result of fire. Heads of field organizations are responsible for establishing and maintaining a fire protection system to ensure that applicable Department of Energy standards are incorporated in the plan and specifications for major modification to existing buildings. Major fire protection improvement projects underway in fiscal year 1980 include

<u>Project</u>	<u>Total Estimated Cost (\$1000s)</u>
Fire Protection Improvements, Los Alamos National Laboratory, Los Alamos, New Mexico	4500
Central Alarm Station, Safeguards, Los Alamos National Laboratory, Los Alamos, New Mexico	7000
Water Main Replacements, Bendix Plant, Kansas City, Missouri	2000
Fire and Safety Improvements, Lawrence Livermore National Laboratory, Livermore, California	2757
Life Safety Corridors, Bendix Plant, Kansas City, Missouri	3100
Upgrade Reliability of Fire Protection, Bendix Plant, Kansas City, Missouri	7800
Fire Wall Construction, Bendix Plant, Kansas City, Missouri	2000
Plantwide Fire Protection, Savannah River Plant, Aiken, South Carolina	6300
Fire Protection Improvements, Brookhaven National Laboratory, Upton, New York	1300
Fire Protection Improvements, Idaho National Engineering Laboratory, Idaho Falls, Idaho	3100

Test Reactor Area Fire Main Replacement, Idaho National Engineering Laboratory, Idaho Falls, Idaho	2200
OSHA and Fire Safety Improvements, Morgantown Energy Technology Center (METC), Morgantown, West Virginia	580
Fire Protection Upgrading, Gaseous Diffusion Plants, Paducah, Kentucky; Oak Ridge, Tennessee; Portsmouth, Ohio	6000
OSHA Modifications, Gaseous Diffusion Plants, Paducah, Kentucky; Oak Ridge, Tennessee; Portsmouth, Ohio	8200

Installation of fixed fire protection systems, particularly automatic sprinkler systems, accounts for a significant number of the projects.

A combination of regular inspections of facilities to identify potential fire-related hazards and periodic appraisals of fire protection programs provides the most effective means of minimizing fire losses during the life of a facility once operations begin. Self-inspections, tests, fire loss potential reviews and appraisals enable management to identify the nature, location, and severity of fire risks and to evaluate the risks in terms of injuries, dollar loss, programmatic interruption, and release of toxic and radioactive materials. It also allows management to estimate the adequacy of fire loss control devices at a facility. Each Department of Energy facility or operation is required to have a fire protection plan that includes, among others, procedures for self-inspection and the means for ensuring compliance with findings and recommendations for improved fire safety.

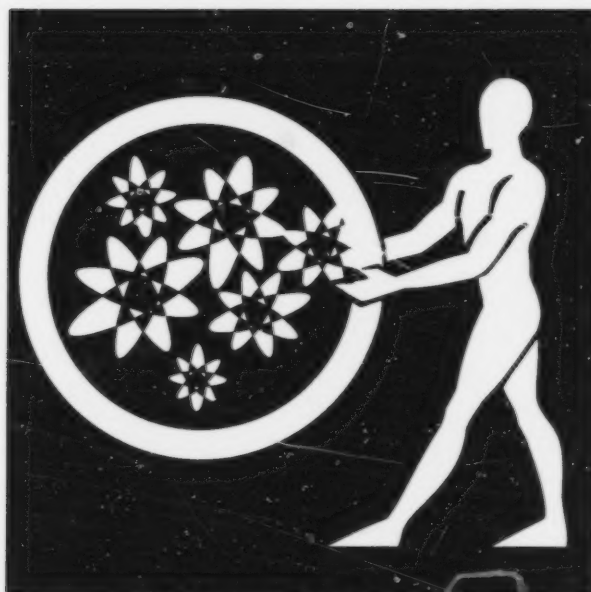
Program appraisals by both Department line program management personnel and by Headquarters staff ensure that fire protection programs are adequate, meet the Department of Energy requirements, and are consistent with other applicable codes and standards.

To strengthen the overall property protection effort, a contract survey program was initiated in 1969 under the Atomic Energy Commission. Consultant fire protection teams conducted periodic surveys at facilities determined to be of major importance to the Commission's mission. This program has continued and expanded under the Department of Energy and is now applicable to all facilities with a replacement value in excess of \$25 million. Some 108 initial and followup surveys and appraisals have been conducted since program inception. Following initial surveys, resurveys are scheduled at each facility at approximately 4-year intervals. Reports of these consultant surveys are submitted to the Assistant Secretary for Environmental Protection, Safety, and Emergency Preparedness, Operational and Environmental Safety Division, for review and transmittal to field organizations and program managers. The appropriate organization then submits an action plan addressing identified discrepancies.

During fiscal year 1980, the current contractors for this program, Schirmer Engineering Corporation and Factory Mutual Engineering Association, completed the following surveys:

- Strategic Petroleum Reserve -- 3 sites, Louisiana, and 2 sites, Texas
- H-Coal Liquefaction Pilot Plant, Catlettsburg, Kentucky
- Naval Petroleum Reserve No. 3, Midwest, Wyoming
- Pantex Plant, Amarillo, Texas
- Oak Ridge Y-12 Plant, Oak Ridge, Tennessee
- Stanford Linear Accelerator Center, Palo Alto, California
- Morgantown Energy Technology Center, Morgantown, West Virginia
- Department of Energy Headquarters (Computers), Washington, D.C., and Germantown, Maryland

Over 700 full-time personnel and 600 volunteers staff some 27 fire departments for the Department of Energy with several thousand additional Federal employees and contractor employees assigned emergency functions. Response capabilities extend from the 97-man Federal fire department operating from the five stations at Los Alamos, New Mexico, to the ones at universities that rely on nearby municipal departments.



**EMERGENCY
PREPAREDNESS**

42A

EMERGENCY PREPAREDNESS

In response to the Kemeny Commission Report on the accident at Three Mile Island, the President on December 7, 1979, directed the Federal Emergency Management Agency (FEMA) to make Interagency assignments delineating agency capabilities and responsibilities for radiological emergency planning and response. FEMA subsequently issued 44 CFR Part 351 in fulfillment of these requirements. The Department of Energy was assigned radiological emergency responsibilities in three areas: response resources, emergency planning and preparedness for Departmental facilities, and support to FEMA and state and local governments in their radiological emergency planning processes. This latter area impacts the licensing of commercial powerplants because FEMA-approved state and local emergency plans are required in the licensing process. Within the Department of Energy, the Assistant Secretary for Environmental Protection, Safety, and Emergency Preparedness has been assigned lead responsibility for planning and management in the event of natural phenomena emergencies (as distinguished from emergencies related to nuclear weapons, special nuclear materials, and security of Department operations).

Emergency Response Resources

The Department possesses unique resources for monitoring and assessing the extent and severity of an accidental release of radioactivity. A mix of fixed and rotary wing aircraft, together with a team of specially trained scientists and technicians using sophisticated remote sensing equipment is maintained by the Department. This capability can be deployed from either an Eastern or a Western base and within a matter of a few hours begin to map offsite ground depositions of radioactivity. In addition, the Department of Energy has developed a computer-based accident management system to predict the transport, diffusion, and deposition of radioactive nuclides that may have been released to the atmosphere during an accident. This team is complemented by a large number of field office and national laboratory personnel whose day-to-day work is in health physics or radiation protection and can be deployed during a radiological emergency.

Remote Sensing

The Department operates the Aerial Measuring System to perform aerial measurements of ground and airborne radioactivity and to develop techniques for refining these measurements and enhancing their interpretation. The Aerial Measuring System has been used for over 20 years to build a base of background surveys around U.S. nuclear facilities, including commercial nuclear powerplants and Department of Energy and Department of Defense owned nuclear facilities. The measuring of extremely low levels of gamma radiation from the air enables the Department of Energy to rapidly search relatively large areas for any changes to pre-accident background radiation levels after an

emergency. This unique Department of Energy capability also has non-emergency applications, such as assisting in pre- and post-cleanup monitoring of locations formerly utilized in various aspects of nuclear operations and calculating water content of snow cover to determine potential danger from spring flooding.

Computer-Based Accident Management

The Atmospheric Release Advisory Capability is a computer-based accident management system, which uses advanced numerical models to estimate the fate of pollutants released to the atmosphere. The geographical scale of its predictions can be varied from global to regional (radii of 100 km) to local (radii of 10 km). These numerical models are processed in a large central computer located at the Lawrence Livermore National Laboratory using local and global weather and local terrain to develop predictions of transport, diffusion, and deposition. These predictions can be displayed on local terminals, if available, or transmitted to local command centers by telephone lines.

Radiological Emergency Assistance

The Department of Energy will provide appropriate radiological advice and assistance as needed from its operations offices and national laboratories to minimize injury and protect public health and safety, upon request from any agency, organization, or individual who has knowledge of a possible hazardous incident involving radioactive material. The Department has also been assigned the lead within the Federal Government for implementing the Federal Radiological Monitoring and Assessment Plan. This Plan provides the framework within which participating Federal agencies coordinate their emergency radiological monitoring and assessment activities with those of state and local governments. Under the Plan, Departmental resources are made available by direct requests to any one of eight Department of Energy Regional Coordinating offices, shown in Figure 4. Major responses are coordinated in the Department of Energy Headquarters when resources beyond the capability of a single office are required.

In addition to the usual kinds of equipment and facilities found in laboratories and production plants working with radioactive materials and other sources of ionizing radiation, there are a number of specialized items of equipment available from Departmental sites. These items are used in performing various functions generally associated with personnel protection or scientific or engineering projects. This specialized equipment includes such items as shielded-cab vehicles, remotely controlled and manned mobile master-slave manipulator systems, special purpose radiation instruments, portable whole-body radiation counters, house trailers converted to mobile personnel radiation decontamination units and health physics laboratories, and portable remote viewing devices.

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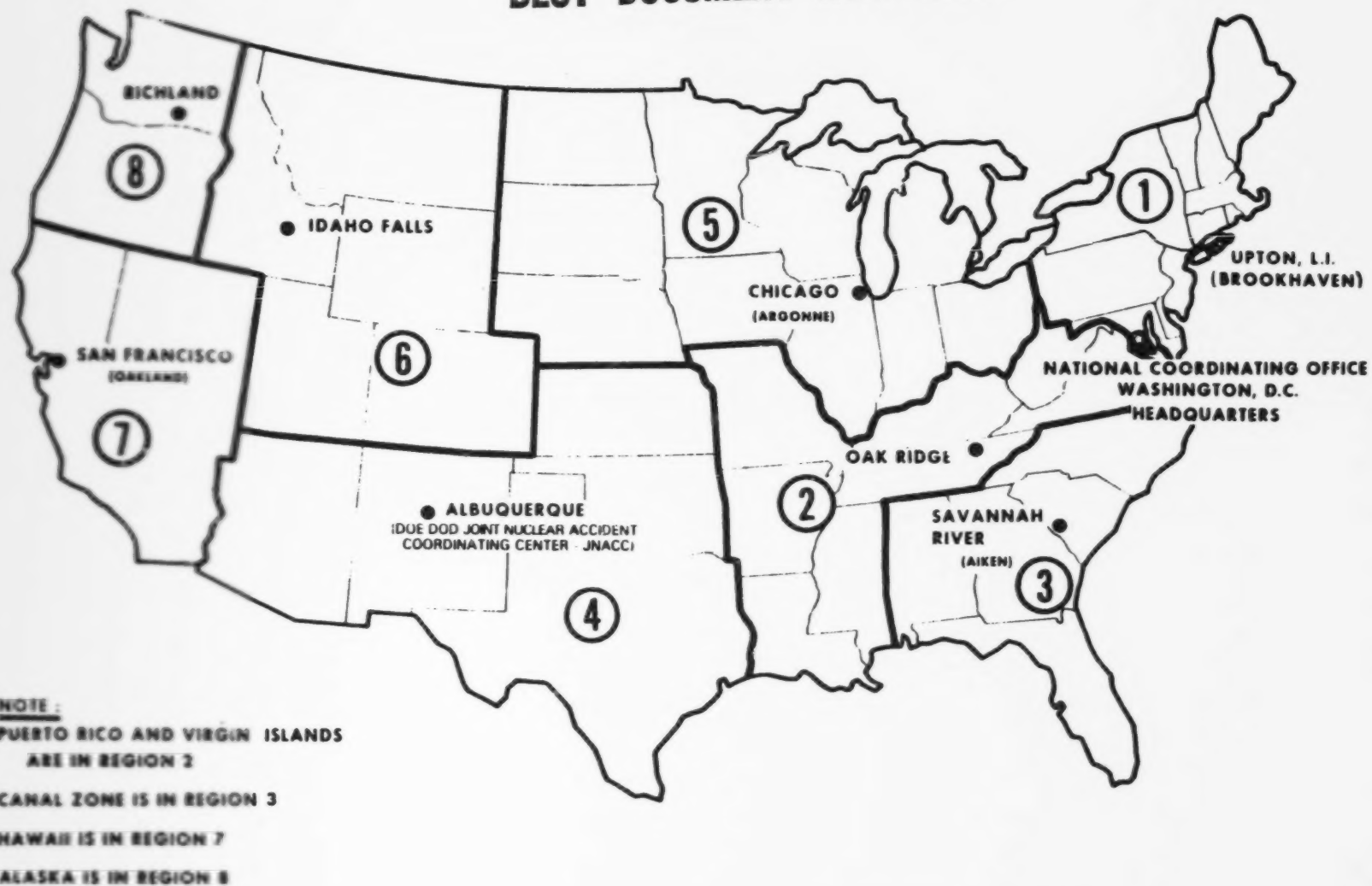


Figure 4. U.S. Department of Energy Regional Coordinating Offices for Radiological Emergency Assistance and Their Geographical Areas of Responsibility

Records are kept of the requests for Department of Energy assistance in emergencies involving suspected, as well as actual, radiological hazards. Calls received from individuals and organizations seeking technical advice and information on radiation protection are excluded from radiological assistance request data unless associated with an emergency situation. These statistics do not include radiological assistance responses that were handled independently by other Federal, state, or local agencies or by private companies that offer radiological protection and health physics services.

A summary of over 20 years of emergency assistance is given in Table 8. The growth in shipment of radioactive materials is reflected in the increase in average weekly requests for assistance. For the first 10 years, assistance requests averaged just over one per week; however, beginning in 1972, they started rising to a current level of over three per week. In 59 percent of the cases, an assistance team was dispatched. Of the total 2205 incidents, 77 percent involved radioactive materials.

Table 8. Summary of Annual Radiological Assistance Response Experience for the Period July 1958 Through December 1980

Calendar Year	Assistance Requests Handled	Assistance Sent				Radioactive Material		
		One Man	One Team	For DOE*	Total Times	Involved	Not Involved	Advice Only
1958-1959**	92	45	22	(1)	67	42	50	25
1960	79	22	15	(1)	37	54	25	42
1961	139***	22	19	(1)	41	58	81	98
1962	68	17	20	(1)	37	51	17	31
1963	57	9	19	(1)	28	42	15	29
1964	59	9	29	(1)	38	54	5	21
1965	78	11	25	(1)	36	69	9	42
1966	73	12	21	(1)	33	49	24	40
1967	70	12	16	(1)	28	49	21	42
1968	75	15	28	14	57	61	14	18
1969	66	8	21	13	42	57	9	24
1970	58	9	15	17	41	47	11	17
1971	66	15	24	14	53	54	12	13
1972	90	5	23	41	69	74	16	21
1973	112	13	21	57	91	104	8	21
1974	175	8	38	72	118	150	25	57
1975	138	5	18	60	83	113	25	55
1976	107	7	19	51	77	79	28	30
1977	127	4	16	41	61	102	25	66
1978	160	11	15	61	87	123	37	73
1979	169	3	22	76	101	146	23	68
1980	147	4	10	66	80	131	16	67
Totals	2205	266	456	583	1305	1709	496	900

* DOE requested another Federal or State agency to send assistance to the incident scene in place of sending a Department of Energy team.

** Data not separated for these years.

*** Includes requests for information reported as requests for assistance.

(1) Data not available.

Table 9 shows the calendar year 1980 incident data by region.

Table 9. Summary of Department of Energy Radiological Assistance Response Experience by Regions for Fiscal Year 1980

Region and Office	Assistance Requests Handled	Assistance Sent				Radioactive Material		
		One Man	One Team	For DOE*	Total Times	Involved	Not Involved	Advice Only
1. New York	25	0	0	21	21	22	3	4
2. Oak Ridge	6	0	1	2	3	4	2	3
3. Savannah River	6	0	0	3	3	6	0	3
4. Albuquerque	50	0	2	6	8	50	0	42
5. Chicago	30	0	3	16	19	22	8	11
6. Idaho	6	1	0	5	6	6	0	0
7. San Francisco	24	3	4	13	20	21	3	4
8. Richland	0	0	0	0	0	0	0	0
Totals	147	4	10	66	80	131	16	67

* DOE requested another Federal or state agency to send assistance to the incident scene in place of sending a Department of Energy team.

Emergency Planning for Department of Energy Facilities

The Department operates a complex of laboratories and industrial plants involved in various operations with radioactive materials, including reactors, weapon components, waste, and accelerators. Each facility maintains viable and tested radiological emergency plans to cope with potential accidents or incidents even though these operations have historically proven safe. The Assistant Secretary for Environmental Protection, Safety, and Emergency Preparedness is charged with the responsibility to oversee radiological emergency planning as it relates to accidents that may occur operationally or as a result of some natural disaster. Much of this responsibility has been delegated to the Operational and Environmental Safety Division for development of operational and environmental safety policy and criteria for the preparation and exercise of radiological emergency plans for Department of Energy controlled facilities. This is accomplished through ad hoc task forces and other channels of communication at the Department of Energy Headquarters level with the various offices having responsibility for field operations. Oversight is carried out through the development of policy and appraisal of appropriate Departmental programs.

Technical Support for Federal, State, and Local Authorities

FEMA considered the capabilities and experience of the various agencies when making assignments within the Executive Branch. Consequently, the Department of Energy, as the largest single operator of

nuclear facilities in the United States, was assigned the responsibility to assist FEMA and state and local governments in reviewing and preparing radiological emergency plans for the regions surrounding commercial nuclear powerplants. FEMA's role is to review state and local radiological emergency preparedness plans, approve them if they meet its criteria, and advise the Nuclear Regulatory Commission. The Commission concurrently reviews the radiological emergency plans of its potential licensee and approves an operating license only if both the licensee's and local jurisdiction's plans are approved by the Commission and FEMA, respectively. FEMA has established a Regional Advisory Committee in each of its 10 regional offices to review emergency plans of state and local governments. Because FEMA has little in-house technical capability to use in reviewing these plans, it depends on the Department of Energy for assistance. This assistance is provided through the Department of Energy field offices.

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**APPRAISAL
PROGRAM**

48A

APPRAISAL PROGRAM

The Department of Energy Order DOE 5480.1, "Environmental Protection, Safety, and Health Protection Program for DOE Operations," establishes the requirement for environmental, safety, and health (ES&H) programs at Departmental and contractor operations. This program provides the means for implementing Departmental policy to ensure protection of (1) the environment, (2) the safety and health of the public and employees, and (3) Government property and to ensure compliance with applicable requirements affecting Federal facilities and operations. The Appraisal Program is an integral component for assuring proper implementation of the Departmental ES&H Program.

Department of Energy Order DOE 5482.1, "Environmental, Safety, and Health Appraisal Program," establishes the program, defines the types and contents of appraisals, assigns responsibilities, and delegates authorities for implementation. The objectives of the ES&H Appraisal Program are to

- Determine that environmental, safety, and health policies and requirements are appropriately interpreted and implemented by Department of Energy and Department of Energy contractor programs and organizations
- Evaluate the effectiveness of individual site implementation of ES&H policies, requirements, and standards
- Provide management with objective, timely, and reliable information on ES&H performance, including significant achievements and deficiencies
- Provide recommendations, where appropriate, for improvement of ES&H Program performance
- Determine the adequacy of the regulations or requirements used for achieving Department of Energy policy and national statutory ES&H goals

The appraisal program consists of a three-tiered review system. The first tier involves internal audits or self-appraisals conducted by management at the first operating level -- those performing the actual work or tasks (e.g., contractor, Energy Technology Center). The second tier includes confirmatory appraisals by the second line organization level -- those contractually or organizationally responsible for managing and overseeing the work of the first level (e.g., operations office, headquarters, assistant secretary). The final or third tier encompasses independent overviews by the Assistant Secretary for Environmental Protection, Safety, and Emergency Preparedness and is conducted by the Operational and Environmental Safety Division.

Two types of appraisals are conducted by the Department: functional and management. The functional appraisal is a review of a specific ES&H discipline to ensure that a proper program has been developed, documented, and implemented for a particular specialty area. Management appraisals evaluate management effectiveness in establishing and operating the ES&H Program and involve a review that encompasses all ES&H disciplines pertinent to the organization or facility being appraised.

Currently, 16 functional or specialty disciplines constitute the Operational and Environmental Safety appraisal program. These disciplines are

1. Environmental Protection
2. Fire Protection
3. Criticality Safety
4. Health Physics
5. Industrial Hygiene
6. Nuclear Facility Safety
7. Occupational Safety
8. Quality Assurance
9. Reactor Safety
10. Process and Facility Safety
11. Transportation Safety
12. Safety Analysis and Review Program
13. Occupational Medicine
14. Aviation Safety
15. Emergency Preparedness
16. Nuclear Weapons Safety

Not all disciplines apply to each Department of Energy or contractor facility. For example, nuclear facility and nuclear weapons safety functional appraisals are not required for a facility that deals with fossil fuels only. Conversely, others, such as environmental protection and fire protection, are specialty areas that need to be addressed in nearly all appraisals regardless of the energy technology under consideration.

Each of the disciplines scheduled for appraisal is evaluated against the 12 factors listed below:

1. Management Directives and Orders
2. Policies, Standards, Permits, and Licenses
3. Organization and Administration
4. Staffing
5. Training
6. Communications
7. Documentation
8. Incident and Accident Reporting
9. Planning, Budgeting, and Spending
10. ES&H Appraisal Programs
11. ES&H Evaluation of Current and Planned Facilities and Programs
12. Performance

These factors have been expanded into an Appraisal Evaluation Reporting Form for use by the Operational and Environmental Safety Division appraisors and provide a measure of consistency and objectivity among the disciplines and between facilities appraised.

Appraisals

Each year, the Policy, Measurements, and Institutional Standards Branch of the Operational and Environmental Safety Division prepares a plan that schedules functional appraisals of second line organization levels. Fifty-seven functional and two management appraisals were conducted during fiscal year 1980.

Over 300 appraisals were conducted by second line organizations as part of their management responsibilities for implementation of the ES&H Program. Additional internal audits were also conducted by first operating level personnel in accordance with Departmental Orders to examine and continually evaluate those portions of the internal ES&H Programs, program implementation plans, and operations under their control to ensure conformity with all applicable Departmental requirements.

Regularly scheduled and thoroughly conducted appraisals assist in achieving the objectives of the ES&H Program and provide a valuable tool to all levels of management. Appraisals conducted by Headquarters personnel during fiscal year 1980 indicate that, in general, the ES&H Program is being carried out effectively by competent professional personnel and that program goals are being achieved. Some areas with the potential for adversely impacting the ES&H Program were noted, however. Examples of these are discussed below under Management and Functional Appraisals.

Management Appraisals -- General Findings

Two management appraisals were conducted in fiscal year 1980. Areas with potential for significantly affecting the Department's ES&H Program noted during the conduct of management appraisals by Headquarters personnel were

- Failure to incorporate applicable ES&H clauses in all contracts
- Lack of adequately defined responsibility for contract administration of ES&H requirements

The Department of Energy places several thousand contracts each year. Twenty-eight contracts, with a total value of over \$10 million were selected by a Headquarters Appraisal Team for review in order to judge the effectiveness of the Department's program for incorporating ES&H requirements into applicable contracts. The appraisal team determined that 6 of the 28 contracts should have contained one or more ES&H clauses. Four of the six contained the appraisal clauses; two did not. This indicates that a significant number of contracts presently in force may not contain necessary ES&H requirements.

The contract review also identified measures needed to ensure future incorporation of appropriate ES&H requirements into new contracts. For instance, the Contract Specialist's Guide, used by the Department as a handbook for contract preparation, did not identify Department of Energy ES&H requirements nor did Autopreps, an automated proposal and contract writing system, contain adequate ES&H data. Contractor ES&H reporting requirements also needed to be included in the Uniform Contractor's Reporting System.

The Department of Energy, through the Assistant Secretary for Environmental Protection, Safety, and Emergency Preparedness, has initiated a program to institutionalize the incorporation of ES&H requirements into the procurement process. For example, the Operational and Environmental Safety Division has prepared an overall reference document, the General Environmental, Safety, and Health Requirements (GEVR) Document, for Department-wide use in identifying applicable ES&H requirements.

Both management appraisals noted instances where responsibility for contract administration for ES&H requirements was not well defined. Some program offices accepted responsibility for all ES&H matters and others apparently assumed that Procurement Operations would ensure compliance with applicable ES&H requirements. However, Procurement Operations does not have ES&H staff or expertise available for this function. The problem is compounded in those situations where administration of a contract has been delegated to an agency outside of the Department of Energy, such as the Defense Logistics Agency, Defense Contract Administrative Services, or the Corps of Engineers. This delegation outside of the Department further clouds responsibility for Departmental ES&H compliance during contract administration.

Functional Appraisals -- General Findings

Appraisals conducted in fiscal year 1980 by Headquarters personnel indicate that adequate ES&H Program plans have been developed, organizational structures have been established, and the ES&H Program is being successfully implemented at the Department of Energy field offices that have been appraised. The appraisals also indicate a variation in the quality of the individual programs and the way that each is implemented. Several areas of concern noted during the appraisals were

- Infrequent appraisal and surveillance of contractor operations
- Staff turnover with accompanying difficulty in filling vacancies with qualified personnel
- Increased workloads without corresponding increases in personnel and funding
- Organization placement of the discipline function within the field office

Second line organization level appraisal of first operating level activities is one of the major keystones of the Department's ES&H Program. It is also one of the areas in the program that requires additional attention. Several factors appear to contribute to this situation, such as personnel limitations and travel restrictions.

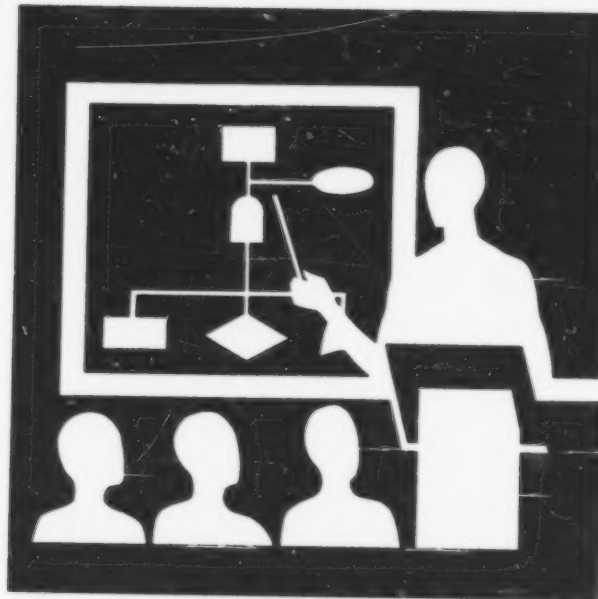
Headquarters' appraisals indicate a generally high level of professional capability in the personnel staffing ES&H functions in the field offices. However, staff turnover and difficulty in obtaining qualified replacement personnel have contributed to reduced effectiveness in several instances. Increased workloads in some discipline areas accompanied by limitations on funding have added to staffing problems. The increased workload has resulted from a number of causes including increased emphasis in certain disciplines, such as emergency preparedness, increased responsibilities for certain facilities and field offices, and new requirements levied by Headquarters or other authority.

The organizational placement of the discipline functions at several field activities does not allow direct access to the office manager and is not in accordance with current directives. In most cases, however, it could not be established that this has significantly affected the quality of the local ES&H Program.

Corrective Action

Upon completion of management and functional appraisals, post-appraisal briefings are held with management and key individuals of the appraised organization to present findings and clarify any questionable areas that may have been noted. A report of the appraisal is prepared by the inspecting team and forwarded to the head of the organization. Findings are explained in sufficient detail to ensure understanding and enable the organization to institute corrective action. Organizations appraised must respond to the formal report within 30 days and indicate what corrective actions are planned. Where necessary, followup visits with management personnel may be made to discuss corrective actions.

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TRAINING

TRAINING

Training is an essential component of the Department of Energy's Environmental Protection, Safety, and Health Protection Program and is accomplished at three levels:

- First operating level
- Second line organization level/Headquarters level
- Program management level

The bulk of training is accomplished at the first operating level and is aimed at performing the task properly, efficiently, and safely. Training and qualification requirements for operating staff are included, where applicable, in the Department's ES&H Program Plan. Additional requirements may be established by Departmental Orders or other authorities. For example, Departmental Order DOE 5480.1, Chapter VI, "Safety of Department of Energy Owned Reactors," establishes requirements for reactor personnel training and qualification. Although the requirements for reactor personnel are more stringent than most, a description of the requirements illustrates the importance the Department attaches to a rigorous training program.

Reactor operator training must, as a minimum, be sufficient to cover the candidate's assigned tasks. The program includes on-the-job training covering all aspects of reactor operations except where conditions, such as construction, prohibit. Training categories include reactor operations, facility design features, general operating characteristics and limitations, instruments and controls, safety and emergency systems, shields, engineered safety features, standard and emergency operating procedures, radiation monitoring systems and survey equipment, radiological safety principles, effects of experiments, and manipulation of reactor controls. Supervisor training, which is more detailed than operator training, emphasizes design and operating limitations, bases for technical specifications, radiation hazards, reactivity effects during experimental and maintenance activities, fuel handling, burn-up and reactivity worth, alternations in core configuration, and certain administrative responsibilities. Each candidate is given written, operational, and oral examinations covering all categories of training. Certification of the individual is granted only after all training and examinations are completed, and management is satisfied that the candidate is capable of performing all assigned tasks. Each reactor operator or supervisor must also undergo refresher training and re-examination at specified intervals. This may be as frequently as annually in some areas but must be completed in all areas at least biennially.

Training requirements and procedures for first operating levels vary from facility to facility and may include subjects as diverse as safe driving and maintenance of reactors. Most facilities are required to

conduct training in preventive medicine and health maintenance for their employees. Areas such as alcohol and drug abuse, mental health, weight control, cardiovascular disease prevention, and cardiopulmonary resuscitation may be included.

Training for second line organization level and Headquarters personnel is directed toward increasing their management abilities. College-level and industrial-sponsored courses of instruction are taken by personnel to improve their professional capabilities and to remain abreast of technological developments pertinent to their areas of responsibilities. Personnel also attend seminars given by Federal and state regulatory agencies covering regulatory compliance.

Each year, the Department of Energy conducts or sponsors a limited number of ES&H-related courses for employees. One is the MORT (Management Oversight and Risk Tree) program. The MORT seminar is conducted under the auspices of the Department's System Safety Development Center located at Idaho Falls, Idaho, under a contract administered by the Idaho Operations Office. The seminar is presented as a central service to all contractors and field offices and is open to all levels of personnel.

The purpose of MORT is to improve the Department's safety program. The objectives of the MORT program are to teach management personnel to

- Prevent safety-related oversights, errors, and omissions, whether in the conduct of specific jobs and tasks, or in the management system that controls the jobs and tasks
- Express risks in quantitative form (to the maximum practicable degree) and refer these risks to proper management levels for appropriate action. Because risk cannot be completely eliminated, it is essential that a thorough analysis be conducted to determine the degree of residual risk, which, with an accepted level of control, can be "assumed" by the responsible line organization
- Make effective allocation of resources to the safety program and to individual hazard control efforts

For over 10 years, the basic 1-week MORT Seminar has been held. These seminars consist of lecture materials incorporating traditional safety concepts, such as hazard review, human performance, and risk assessment, and innovative safety concepts, such as barrier analysis, change analysis, and tracing of unwanted energy transfer. During detailed study of these concepts, participants focus on three major concerns: specific oversights and omissions, assumed risks, and general management system weaknesses. The Department of Energy Headquarters sponsored five MORT Seminars in fiscal year 1980, and another five were sponsored by other Department and contractor organizations. Approximately 300 personnel attended the 10 seminars in fiscal year 1980; over 1600 have participated since the program began.

Training activities were expanded in 1974 to include an Accident/Incident (A/I) Investigation Workshop. Prior attendance at a MORT Seminar is a prerequisite to the A/I Workshop. Subjects included in the workshop are

- Analytical methods to be employed in investigation
- Information collection
- Risk projection
- Human behavior considerations
- Reports of actual accident investigation experiences
- Roles of specialists in investigation
- Administrative considerations in investigation
- Structuring the investigation report

The A/I Workshop is based on actual case study and role-playing exercises, which simulate the accident situation to the highest practicable degree. Since the inception of this course, the quality of accident investigation reports has improved. This is due in part to the investigation techniques developed for the A/I Workshop and, in part to the fact that the Department requires all Type A and B (Appendix A) investigations to have at least one member with A/I training. Three A/I Workshops and three refresher courses were sponsored in fiscal year 1980 with 119 attendees.

In 1979, a safety appraisal workshop was developed to enhance the capability of Departmental Federal and contractor employees to perform safety appraisals. Although the emphasis was placed on the second line organization appraisals of first operating level functions, wide participation in the program has resulted in further MORT diagnostic use on a day-to-day basis at the operating level. Three appraisal courses were presented in fiscal year 1980 with approximately 70 attendees.

The Department offers two training courses to increase the consciousness and knowledge of the ES&H Program and responsibilities.

"The National Environmental Policy Act and Environmental, Safety, and Health Requirements Training Course" is directed toward mid-level management personnel in the Project Management Offices. The course

- Provides an overview of the Department of Energy's ES&H Program and its requirements, including applicable Orders and information sources
- Describes the Department of Energy's business instruments and contract clauses used in contractual instruments to ensure compliance with ES&H requirements

- Presents an overview of program/project development in relation to contract procurement activities and where ES&H requirements are to be factored into the process

The second training course is for new Project Managers in which approximately 3 days out of the total 10 day course relate to the Department's ES&H Program. During 1980, the two ES&H training courses were presented 15 times, with approximately 500 people in attendance.

APPENDIX A

APPENDIX A
Department of Energy Criteria for Accident Investigation

Events that require Type A or B investigations are defined in Department of Energy Order 5484.1, "Environmental Protection, Safety, and Health Protection Reporting Requirements."

Type A

Incident (Accident)

1. Any fatal or imminently fatal occupational injury or occupational illness involving a Department of Energy or Department of Energy contractor employee or a member of the public due to an occurrence associated with the Department of Energy or a Department of Energy operation.
2. Any lost workday case due to an occupational injury or illness of five or more persons as a result of one occurrence in Department of Energy or Department of Energy contractor operation.
3. An occurrence resulting in an estimated loss or damage to Department of Energy or other property amounting to \$250,000 or more, or requiring an estimated \$250,000 or more for cleaning (including decontamination), renovating, replacing or rehabilitating structures, equipment, or property.
4. Any occurrence involving a nuclear weapon or device (under jurisdiction of the Department of Energy) where there is personal injury or damage to private property.

Loss of Material

Any apparent loss or theft of byproduct or other radioactive material in such quantities and under such circumstances that it could constitute a hazard to the health and safety of individuals. Where this involves the possible theft of Government property, the Federal Bureau of Investigation shall be notified (for a decision as to acceptance of investigation jurisdiction).

Radiation Exposure

1. A single or annual accumulated whole body exposure of an individual to 25 rem or more of radiation, a single exposure to the skin of the whole body of an individual to 75 rem or more of radiation, a single exposure of the forearms of an individual of 150 rem or more, or a single exposure of the hands or feet of any individual to 375 rem or more of radiation.

2. Any internal uptake of radioactive material that, on the basis of early assay data, will result in a dose commitment in excess of five times the annual standard set forth in DOE Order 5480.1, reference ERDAM 0524.

Other

1. Any nuclear criticality in a system not intended to reach criticality.
2. Any accidental release of pollutants that results in or could result in a significant effect on the public or on the offsite environment or that requires activation of the Environmental Protection Agency or the U.S. Coast Guard National Contingency Plan.

Type B

Incident (Accident)

1. Any loss or damage to Department of Energy or other property of \$50,000 to \$250,000 where loss or costs are incurred for cleaning (including decontamination), renovating, replacing, repairing, or rehabilitating structures, equipment, or property.
2. An occupational illness that requires hospitalization, involves five or more persons of which one is a lost workday case, or results in more than five days away from work.

Radiation Exposure

1. Any radiation exposure to an individual that in one calendar quarter exceeds the following:
 - o 5 rem to the whole body
 - o 15 rem to skin of whole body or thyroid
 - o 30 rem to the forearms
 - o 75 rem to the hands or feet
2. Any internal uptake of radioactive material that, on the basis of a small number of early assay data, will result in a dose or dose commitment in excess of the pertinent annual standard set forth in DOE Order 5480.1, reference ERDAM 0524.

Other

1. Any unplanned nuclear excursion in a reactor that is clearly outside routine experience.
2. Any release of radioactive material in concentrations that, if averaged over a period of 24 hours, would exceed 5000 times the limits specified for such materials in DOE Order 5480.1, reference ERDAM 0524.

3. Any release of radioactive material offsite where it is believed any member of the general population may have received an exposure greater than the annual standard set forth in DOE Order 5480.1, reference ERDAM 0524.

APPENDIX B

APPENDIX B
Summaries of Accident Investigations

Fatalities

1. Automobile Accident - Livermore, California One Fatality
October 2, 1979

An employee of the Lawrence Livermore National Laboratory received fatal injuries from an automobile accident at an intersection. The accident occurred when another driver failed to stop at the red flashing light of the intersection and struck the employee's vehicle. The employee died on June 16, 1980.

The primary cause of the collision was the failure of the other driver to understand the need to stop at the red flashing light. A contributing factor to the collision was the failure of the employee to observe that the other vehicle was not stopping. Contributing to the seriousness of the injuries were the non-use of seat belts and a deteriorating door mechanism on the employee's vehicle. The use of flashing traffic signals, instead of fully operating signals, may have contributed to the accident.

2. Collapse During Physical Test - Richland, Washington One Fatality
October 23, 1979

A 53-year-old Rockwell Hanford patrolman with 32 years of service collapsed and died of a cardiac event while participating for the first time in a physical fitness test at the Hanford Site. The physical fitness test is a requirement of DOE Interim Management Directive (IMD) 6102, Appendix IV, Security Inspector Physical Fitness Qualification. This Directive was issued January 31, 1979, effective May 1, 1979, and amended August 13, 1979.

Medical advisors to the Investigation Board did not feel the cardiac event was entirely the result of exertional effort during the physical fitness course and some impact of emotional stress was likely. The ability to detect potential cardiac events is not an exact science; therefore, the most probable cause of the specific cardiac event could not be determined. The Board concluded the most significant contributory cause was the failure to determine the patrolman's physical capability and exercise tolerance as required by IMD 6102.

3. Airplane Crash - Livermore, California Three Fatalities
November 16, 1979

Three employees of the Lawrence Livermore National Laboratory died in the crash of a Cessna 182 aircraft. They were returning from a business trip to the Nevada Test Site when the crash occurred while on approach to the Livermore airport.

Weather conditions were severe with driving rain, high winds, and poor visibility. The plane, which was piloted by one of the employees, was one of six aircraft leased by the Flying Particles (a flying club for Laboratory employees). The National Transportation Safety Board conducted an investigation of the accident.

4. Fall Down Mine Service Shaft - New Iberia, Louisiana One Fatality
February 1, 1980

A construction worker employed for one week by Dravo Construction Company was fatally injured as a result of a 400-foot fall down a mine service shaft at the Weeks Island site of the Strategic Petroleum Reserve. The employee was working on the shaft collar level inside the headframe building above the service shaft, grinding ridges left by cement forms. He was wearing a safety belt but was not using a safety line when he fell through the partially covered shaft opening.

The Accident Investigation Board found that, at the time of the accident, deficient supervisory controls allowed work to be done without adequate precautions being taken against safety hazards that existed in the work area. Observations made of the work area indicate general industrial safety precautions were not observed on a continual basis. The subcontractor's documented safety program was not adhered to in areas germane to the accident. The Board also found the subcontractor, contractor, and supporting contractor safety inspection programs lacking in the areas (i.e., planning, reporting, initiative, thoroughness, and corrective action assurance) needed to enforce construction safety requirements. Additionally, contractor and subcontractor site management did not adequately enforce contractual safety requirements.

5. Missing Helicopter - Chesapeake Bay, Maryland One Fatality
March 24, 1980 Property Loss \$307,000

A DOE-owned Hughes H-500 helicopter with two persons aboard left Andrews Air Force Base and never arrived at Summit Air Park, Middletown, Delaware. The helicopter is attached to the Eastern Measurements Office which is operated for the DOE by EG&G, Washington Aerial Measurements Department.

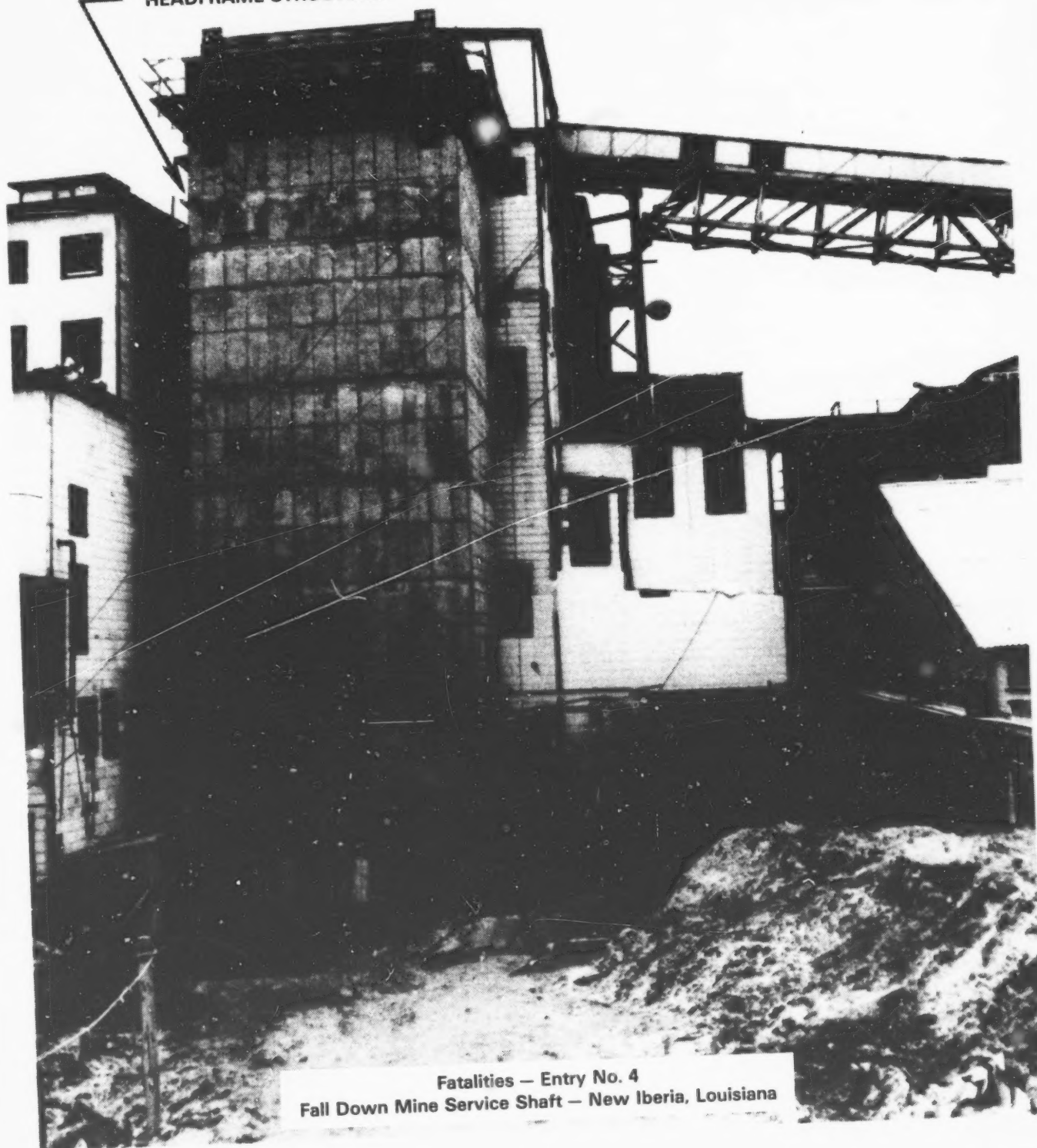
The pilot, an employee of EG&G, Washington Aerial Measurements Department, was accompanied by an Andrews FAA controller/instructor pilot. The 50-minute flight was being made to pick up navigation equipment.

Although systematic search efforts conducted with boat and sonar failed to locate the submerged aircraft, several objects belonging to the helicopter and occupants were found by citizens along the eastern shore of Chesapeake Bay. The bodies of the pilot and passenger were discovered on April 28. Unless the main wreckage is found, a primary causal factor will probably not be determined.

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HEADFRAME STRUCTURE



Fatalities — Entry No. 4
Fall Down Mine Service Shaft — New Iberia, Louisiana

666 BEST DOCUMENT AVAILABLE

6. Fall of Well Casing - West Hackberry, Louisiana One Fatality
March 27, 1980

A floor helper on a drill rig was fatally injured at the Strategic Petroleum Reserve. He was an employee of Benton Casing Company, a subcontractor to Texas Brine. He and a tong operator were running casing into Well 6B of Cavern 6. A casing joint which had been hoisted to a nearly vertical position over the drill rig floor fell from the pickup line and struck them. The floor helper died immediately from multiple fractures of the skull. The tong operator received injuries requiring hospitalization.

The primary causal factor was the failure of a braided wire rope pickup line to maintain a secure grip while hoisting a casing joint. Although the pickup line itself did not fail structurally, the Investigation Board determined that the pickup line did fail to maintain a secure grip around the casing.

Contributing factors which may have affected the sequence of events leading to this accident include: the tip of the sliding hook on the pickup line had been cut off; the casing crew's inexperience and lack of training; poor signal communications on the rig floor; the slow hoisting rate and horizontal movement of the traveling block; inclement weather, and a crowded work area.

7. Fall From Power Pole - Finley, North Dakota One Fatality
April 14, 1980

An employee of Christiansen Painting, Inc., contractor to the Western Area Power Administration, fell 50 feet to the ground from a 115 kV power transmission pole. He was a member of a three-party crew, who climbed, inspected, and treated power transmission line poles to prevent deterioration of the poles.

The employee was applying a preservative to a 65-foot double pole when the accident occurred. Although no one saw him actually fall free of the pole, his fall to the ground was seen by the other workers. The injured employee died in an ambulance enroute to Mayville Union Hospital.

Investigation of the accident did not positively identify the cause for the fall. However, the probable causes were the employee lost his grip or he thought the safety strap was hooked when it was not and let go of the pole.

8. Automobile Accident - Arkansas One Fatality
May 5, 1980

A Region VI employee died as the result of injuries sustained in a motor vehicle accident while he was on official business. The accident was investigated by the Arkansas State Police.

Property Loss

1. Failure of Chain Hoists - Nye County, Nevada
January 16, 1980 Property Loss - \$50,000

Two chain hoists broke while a forklift operator at the Nevada Test Site was assisting another forklift operator. He had raised the end of a drilling rig line when the accident occurred.

The tines, carriage, and ram fell. The left tine struck a parked carryall. The failure of the chain was due to unseen metal fatigue.

2. Fall of Drilling Rig - Nye County, Nevada Property Loss - \$50,000
January 22, 1980

A drilling rig tipped over at the Nevada Test Site. Property loss included damaged and bent struts, frame, and mast. The rig had been set, leveled and left over the weekend with drilling to begin Monday morning.

During the weekend, the loose, sandy loam upon which it rested, had frozen and then thawed at the surface. This loose soil coupled with drilling vibrations caused the casing hole to cave in.

3. Earthquake - Livermore, California Property Loss - \$3,016,008
January 24, 1980 Lawrence Livermore National Laboratory

Property Loss - \$400,000
Sandia National Laboratory

About 11 a.m., two earthquakes with magnitudes of 5.5 and 5.3 on the Richter scale were centered 10 miles north of Livermore. Although conservatively designed critical facilities were essentially undamaged, structural damage and loss of equipment occurred at two DOE facilities in Livermore. Many offices and laboratories suffered damage from falling ceiling tiles and light fixtures, tipped files and bookcases, chemical and glassware spills, water, and some natural gas leaks.

At Lawrence Livermore National Laboratory, 44 employees received minor injuries. A number of trailers slipped off their supporting jacks, and two high-rise buildings experienced structural damage.

A low level radioactive leak occurred in a 30,000-gallon tank of radioactive waste water containing tritium, which was collected in an impermeable containment basin. The leak was controlled by placement of concrete into the vat of liquid. No offsite release occurred.

A third earthquake on January 26 caused power outage in the computer area and glass breakage in the radiochemistry building at Lawrence Livermore National Laboratory.

At Sandia National Laboratory, 13 employees received minor injuries. The Tritium Research Laboratory building and other permanent structures experienced structural and architectural damage. No tritium was released to the environment.

4. Building Fire - Tupman, California Property Loss - \$200,000
February 13, 1980

Fire swept through a quonset hut at the Naval Petroleum Reserve No. 1 after personnel had left the area. The structure, which did not have a fire sprinkler system, was used as a workshop and storage area for control valves and repair equipment. Heating was supplied by three gas heaters, of which one had a continuous pilot light.

The property loss included loss of the structure, the stored valves, and repair equipment as well as damage to three pickup trucks belonging to Williams Brothers. No personnel injuries were sustained as a result of the fire.

In order to suppress the blaze, it was necessary to move the burning debris. This operation prevented an exact examination to determine the cause of the fire. On the basis of testimony and evaluation of conditions at the time of the fire, the Investigation Board concluded that the pilot light on the heater was the only source of ignition that could be established.

5. Fire in Compressor - Richland, Washington Property Loss - \$223,000
February 19, 1980

A fire occurred in the E-142 compressor in the Fast Flux Test Facility on the Hanford Reservation. The reactor was shutdown at refueling temperature following initial core loading.

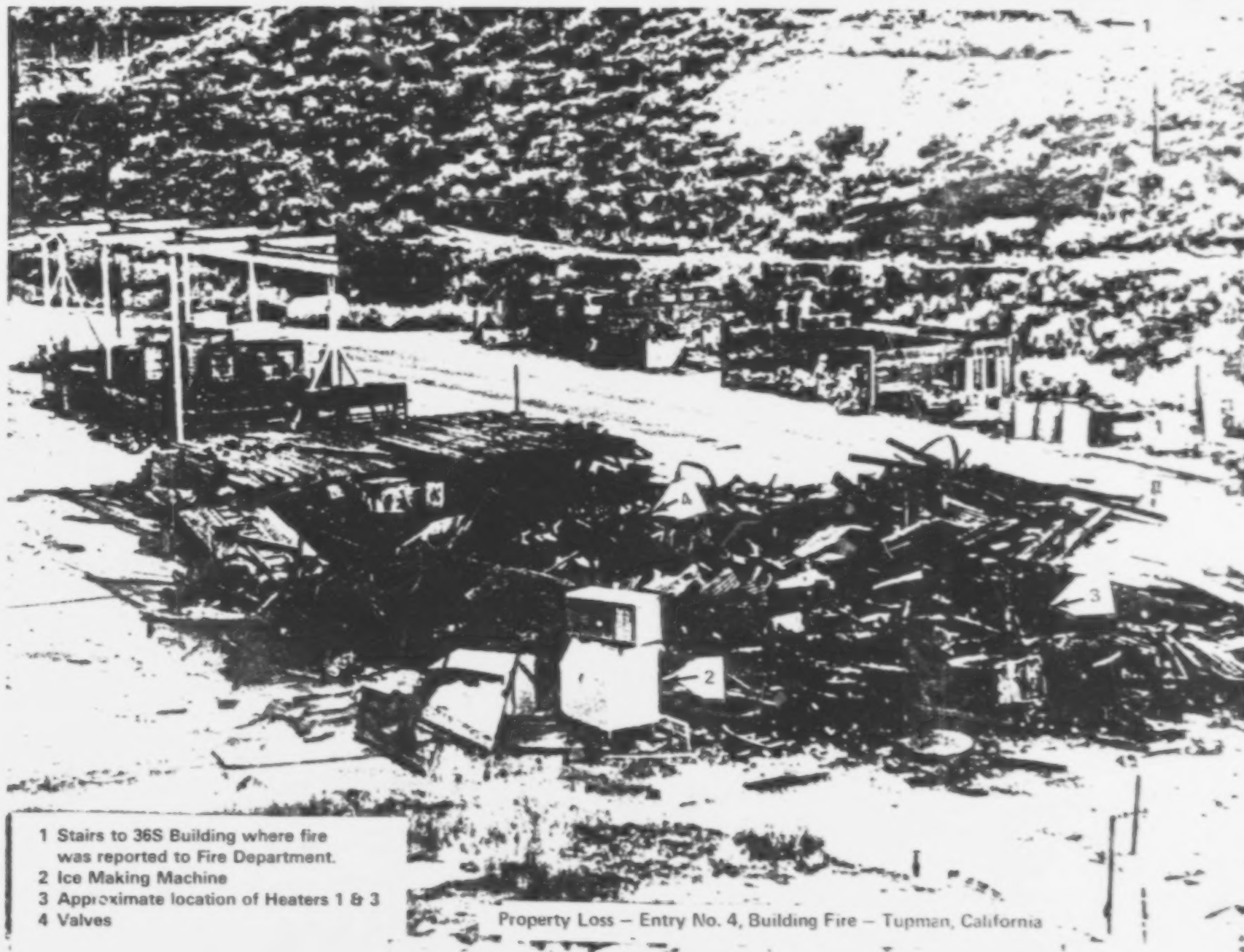
Due to operator error and improper installation of a plant change, an in-containment chiller unit was started without cooling or lubrication and run for a few minutes. The resulting internal fire caused a possible release of phosgene gas and equipment damage.

The fire extinguished itself. No personnel were injured, and the incident did not affect the health and safety of the public.

6. Drop of Pipe Trench Cover - Richland, Washington Property Loss - \$1,174,000
February 27, 1980

A canyon pipe trench cover block slid into the trench containing the piping at the 222B Fractionization Building on the Hanford Reservation. The facility is operated by Rockwell Hanford Operations.

The massive cover block had been removed for maintenance and was temporarily placed near the open trench. The cover block was unintentionally upset and dropped into the trench while an adjacent cover block was being moved by a remotely controlled crane.



- 1 Stairs to 36S Building where fire was reported to Fire Department.
- 2 Ice Making Machine
- 3 Approximate location of Heaters 1 & 3
- 4 Valves

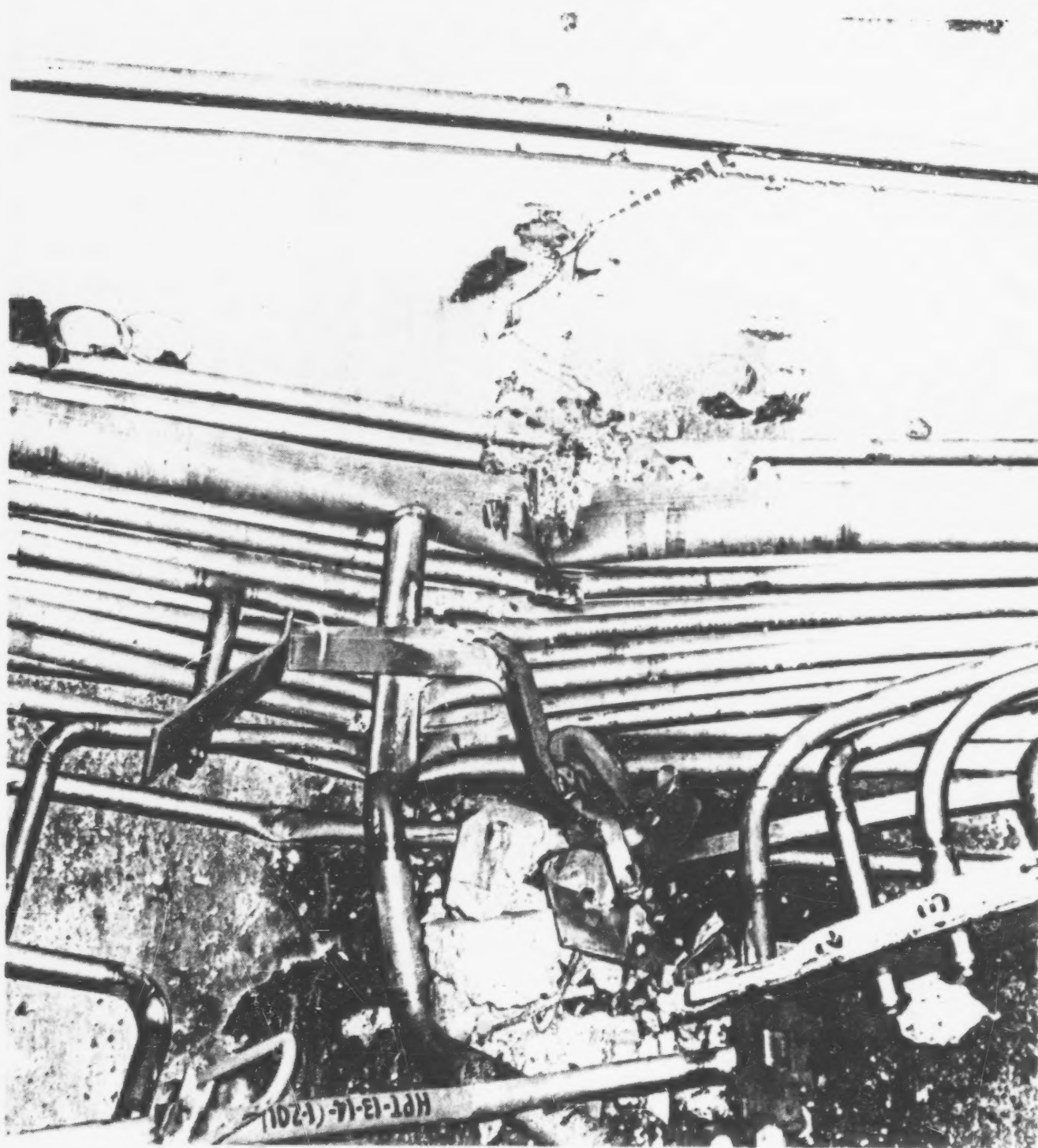
Property Loss — Entry No. 4, Building Fire — Tupman, California

BUILDING 321-36S LOOKING SOUTHWEST

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Damaged Pipes in Hot Pipe Trench



Property Loss — Entry No. 6, Drop of Pipe Trench Cover — Richland, Washington

BEST DOCUMENT AVAILABLE

The incident involved no personnel injury, contamination, radiation release, or public impact. The property loss included the cost of repairing the process piping.

7. Fire in Generator - Tullahoma, Tennessee Property Loss - \$154,250
March 5, 1980

A fire occurred at the High Performance Demonstration Experiment Facility at Arnold Engineering Development Center. ARO, Inc., is the contractor operator for the center, which is located on the Arnold Air Force Base and is operated under a 1974 interagency agreement involving the Department of Energy.

A magnetohydrodynamic generator malfunctioned during test operations resulting in overheating and burning of wire insulation. Although no personnel were injured, electrical wiring, meters, and terminal panels were damaged.

8. Missing Helicopter - Chesapeake Bay, Maryland
March 24, 1980 Property Loss - \$307,000
One Fatality

A summary of this accident is given under "Fatalities" Entry No. 5.

9. Overpressurization of Glovebox--Two Incidents - Livermore, California
April 8, 1980 Property Loss - \$294,000
April 16, 1980 Environmental Release
Contamination of Room

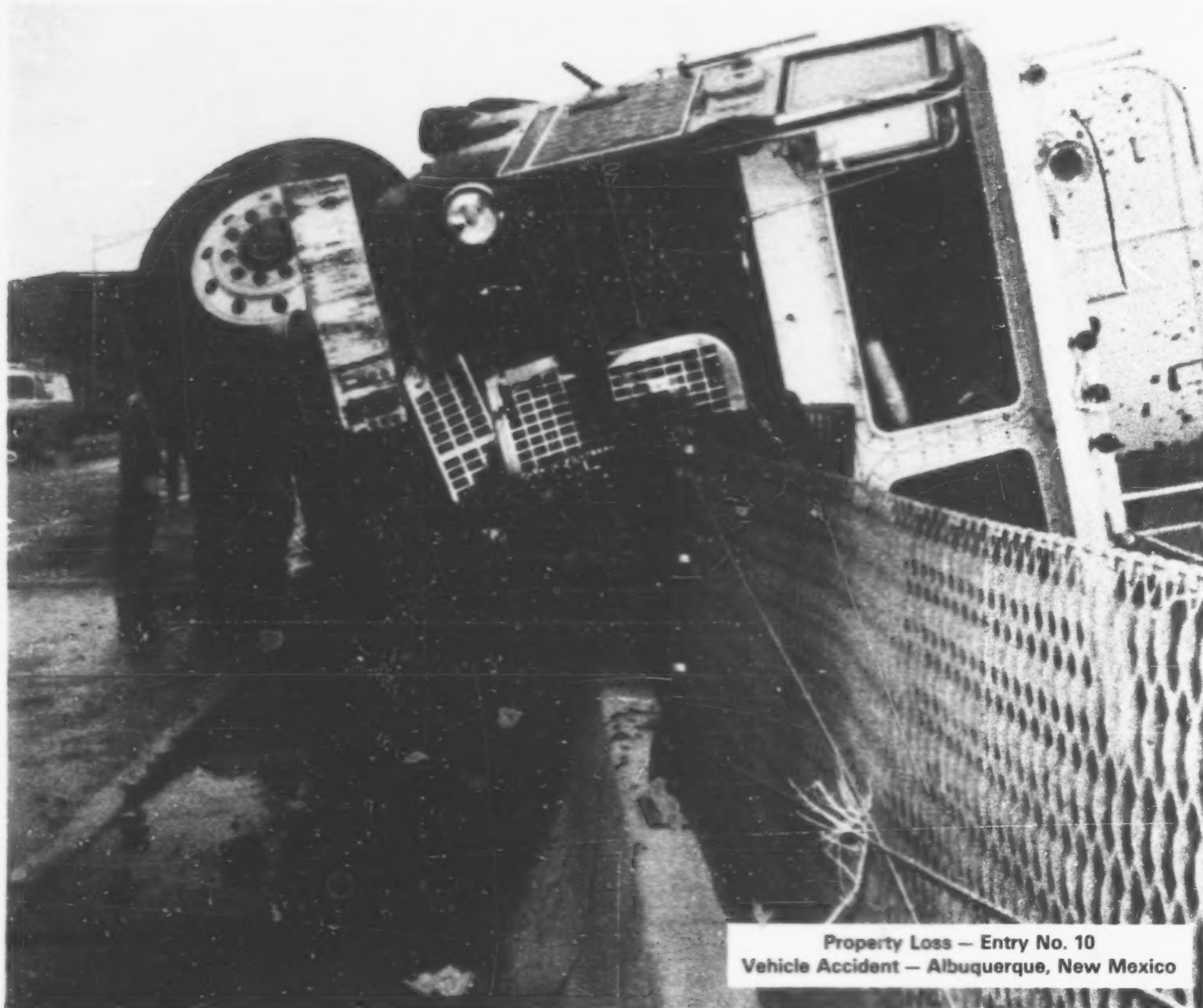
In the first incident, plutonium hydride (plutonium 239) was inadvertently released from a glovebox in the plutonium building at the Lawrence Livermore National Laboratory. The glovebox was under a recirculating argon purge for preparation of research work at the time of the occurrence. The incident resulted in plutonium contamination levels over 100,000 d/m/100 cm² in the research laboratory room and the escape of trace amounts of plutonium oxide particles through filters into the atmosphere. There were no injuries or exposures of personnel. The property loss included \$79,000 equipment damage and \$215,000 cleanup costs.

The second incident occurred in an adjacent laboratory area in the same building. The overpressurization caused the glovebox window to separate from the box. There were no injuries or personnel exposures. Monitors in the filtered ventilation exhaust system showed no release to the atmosphere. Contamination levels of about 25,000 d/m/100 cm² were contained in the laboratory room. No cleanup costs were reported for the second incident.

10. Vehicle Accident - Albuquerque, New Mexico Property Loss - \$95,000
April 21, 1980

A tractor/trailer rig belonging to the Transportation Safeguards Division, Albuquerque Operations Office, struck a sedan on Interstate 40. It was raining and the driver of the rig had tried to avoid colliding with the sedan as it entered the highway from an entrance ramp.

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Property Loss — Entry No. 10
Vehicle Accident — Albuquerque, New Mexico

The rig veered across three traffic lanes, impacting the concrete divider with great force. The tractor and trailer rolled on their left sides. The tractor was damaged beyond repair, and the trailer received extensive damage. The driver and two other crew members were not wearing safety belts and were jostled about the cab.

The accident was caused by the driver of the sedan who was driving too fast under the conditions and lost control of the vehicle.

11. Damage to Fusion Research Facility - Oak Ridge, Tennessee
June 12, 1980 Property Loss - \$150,000

An accident at the Elmo Bumpy Torus fusion research facility resulted in damage to six of the reactor's 24 copper magnet coils. The facility is located at the Y-12 Plant and is in the same building with an experiment being performed for the Nuclear Regulatory Commission. Although the two experiments are physically separated, they share the same power supply.

The Elmo Bumpy Torus was shutdown with safety interlocks in effect to preclude its operation. Apparently, the interlocks failed, while the other experimental apparatus was being operated, allowing the coils to be energized while the coil cooling system was not in operation. The coils overheated; six of them will require replacement. The fusion research facility was expected to be out of service for two months.

12. Gas Explosion - Oak Ridge, Tennessee Property
July 17, 1980 Loss - \$50,000

A gas explosion occurred at the Oak Ridge Y-12 Plant. Arcing in the ground resistor string at the 150 kV power supply generated an explosive gas mixture.

The resulting gas explosion caused severe damage to one of the transfer modules and other components. No employees were injured.

Radiation Accidents

1. Radiation Exposure - Fernald, Ohio One Individual
January 2 - April 2, 1980

A chemical operator in Plant 5 at the Feed Materials Production Center received a radiation dose of 8.69 rem to the skin of the whole body. This reading exceeded the Department of Energy occupational radiation standards for the permissible maximum dose of 3 rem per quarter and 5 rem per year.

The employee's job involved loading graphite crucibles with approximately 1400 pounds of uranium metal scrap for remelting. This task was performed in the plant for a number of years by workers receiving a maximum dose of 1 rem per quarter. Although investigators found no single

apparent reason for the excessive dose, poor material handling methods and an unusual number of remelts involving ingot crop ends were believed to be contributing factors.

2. Overpressurization of Glovebox--Two Incidents - Livermore, California
April 8, 1980 Environmental Release
April 16, 1980 Contamination of Room
Property Damage - \$294,000

A summary of these accidents is given under "Property Loss" Entry No. 9.

3. Contaminated Puncture Wounds - Miamisburg, Ohio One Individual
April 22, 1980

A mechanic employed by Monsanto Research Corporation at the Mound Laboratory noticed two small puncture wounds on his left hand after moving equipment in the plutonium processing building. He could not recall how the injury occurred.

After scrubbing, some contamination was found in both punctures. The wounds were excised by the plant physician. The excised tissue contained 0.08 microcuries of plutonium-238. Although no contamination was detected on a nosewipe, a lung count was made indicating less than 1 permissible lung burden. The employee received daily DTPA treatments through April 24 to flush out any plutonium his body may have absorbed.

4. Fire in Fume Hood - Berkeley, California Release of Non-Hazardous
May 15, 1980 Amounts of Radioactive
Material

A fire occurred in a fume hood in Building 70A at the Lawrence Berkeley National Laboratory. Some microcurie quantities of americium-234, plutonium-242, neptunium-237, uranium-232, cesium-137, and tritium were stored in an aqueous solution in the hood. Initial monitoring showed non-hazardous quantities of material were released.

The probable cause of the fire was the spontaneous combustion of some sodium perchlorate that was also being stored in the hood. Property damage and decontamination cleanup costs were \$5,000.

5. Radiation Badge Exposure - Grand Junction, Colorado One Film Badge
May 1 - 31, 1980

A film badge which had been issued to an employee of Bendix Field Engineering Corporation showed readings of 5.6 rem gamma and 38.9 rem beta for the month of May. These readings exceeded the Department of Energy occupational radiation standards for the permissible maximum dose of 3 rem per quarter and 5 rem per year.

Investigation of the incident indicated that the employee had not engaged in any duties during this period that would require wearing a film badge. During the entire month, the badge was left on a bookcase shelf near some high grade uranium ore samples. The incident brought attention to the unnecessary issuance of film badges to employees who have no current tasks justifying their issuance.

6. Radiation Badge Exposure - Livermore, California One Film Badge
July 3, 1980

During the scheduled processing of thermoluminescent dosimeters (TLDs) at the Lawrence Livermore National Laboratory, one dosimeter indicated a dose of 50 rem. The reading exceeded the Department of Energy occupational radiation standards for the permissible maximum dose of 3 rem per quarter and 5 rem per year. The badge had been worn for about a year by a construction engineer employed by Kaiser Engineering on the NOVA laser-fusion construction site.

The Investigation Board determined that the reading of 50 rem was valid. However, on the basis of medical examinations and cytogenetic evaluation, it is improbable the employee received a 50-rem whole body dose.

The employee did not have access to high radiation sources in the course of his work at the construction site. The high TLD readings resulted from exposure(s) to unknown photon radiation sources(s). The Investigation Board found evidence that supports the improbability that such exposure(s) occurred at the Lawrence Livermore National Laboratory.

7. Plutonium Contamination - Argonne, Illinois One Individual
August 25, 1980

A localized area of the hair of a chemist employed at the New Brunswick Laboratory was contaminated with a small amount of plutonium. Surveys also found minor contamination in the employee's automobile and apartment.

The contamination apparently resulted from activities on Friday, August 22, 1980. On that day, the chemist experienced hand and shoe contamination, which was satisfactorily cleaned. However, she left the laboratory without having her hair monitored.

The Investigation Board determined that the most probable cause of the initial contamination of the chemist's hair was the possibility that she placed her head very close to a glovebox port and the hair was momentarily sucked inside and contaminated. Contamination was spread to offsite locations due to incomplete procedures for personal contamination monitoring.

Management-related problems which were considered to be contributory causes included the need for complete personal contamination monitoring when hand or shoe contamination is detected and a review of protective

clothing, plutonium containment, procedures for transferring items from gloveboxes, and general "housekeeping" inside the gloveboxes.

8. Breakage of Vial Containing Promethium - Argonne, Illinois
August 28, 1980
Contamination of 30
Individuals, 2 Buildings
and Several Security
Vehicles

Small amounts of promethium-147 were detected on the shoes and hands of a security guard making a routine survey of Building 205 at the Argonne National Laboratory. A subsequent investigation by health physics personnel detected contamination in various locations in Building 21, on several security vehicles, and on 29 persons. All of the contamination was removed.

The source of the contamination was the damaged front sight of an M-16 rifle which had been used during a routine security training exercise. The rifle sight contained promethium isotopes bound in 3M brand microspheres. A vial containing the microspheres and a phosphor was inserted in a front sight post. The faint glow produced at the front rifle sight permitted a target to be seen at night. The sight was probably damaged during the transport from the security building to the training area when 13 rifles were stacked on the floor of a jeep.

Costs associated with the contamination incident were about \$22,500 and included the services of Security, Reclamation, and Occupational Health and Safety, as well as overtime wages. The costs do not include the \$600 purchase price of the 13 gun sights, which have been dismantled and disposed of as radioactive waste.

No single factor was isolated as the direct cause of the incident, but rather a sequence of events and a lack of certain procedures all contributed to the accidental breakage and resultant contamination. Management-related problems included the absence of preventive maintenance procedures, the inadequate followup action during the early stages of a contamination incident, and insufficient steps to assure appropriate overall command control of a contamination incident during the initial response.

Other Investigations

1. Hunting Accident - Aiken, South Carolina
November 16, 1979
One Fatality
(Non-Occupational)

A hunter died after being shot by another hunter during an organized deer hunt on the Savannah River Plant site. The program of controlled hunts was initiated in 1965 to reduce the increasing frequency of deer/vehicle collisions and to maintain a healthy deer herd within the capacity of the habitat.

The Investigation Board concluded the fatality was a preventable accident. The victim was complying with the deer hunt rules and regulations applicable to still hunts. However, the shooter did not have positive target identification prior to firing. He shot at sound and movement.

2. Automobile Accident - Santa Fe, New Mexico One Fatality
December 6, 1979 (Non-Occupational)

An employee of the Los Alamos National Laboratory received fatal injuries from an automobile accident. The victim had driven his personal vehicle to Santa Fe to pick up some instruments for the Laboratory. During his return to Los Alamos, he struck the rear of a pickup truck stopped for a traffic light.

He was hospitalized for a week and released, but was later rehospitalized. He succumbed from the injuries on January 24, 1980. The Santa Fe Police Department conducted a routine investigation.

3. Liquid Spill - Fort Lewis, Washington Spill of Solvent Refined
December 19-20, 1979 Coal Process Liquids

During an operation to fill 50 drums with processed solvent refined coal at the Solvent Refined Coal Pilot Plant, a spill of approximately 2300 gallons of liquid occurred. No employees were injured, and there was no offsite environmental contamination.

The probable cause of the spill was human error. The liquids escaped from a bleeder valve in the transfer line, which was inexplicably left open. Additional factors contributing to the incident were the facts that the operation was conducted at night, and the presence of steam and noise which partially obscured the possibility of detecting the spill.

4. Apparent Suicide - Berkeley, California One Fatality
March 9, 1980 (Non-Occupational)

A 27-year-old female employee of the Biomedical Division of Lawrence Berkeley National Laboratory was found seriously injured and unconscious outside a basement entrance. She was transported to Herrick Memorial Hospital and expired shortly thereafter from multiple injuries. The deceased left a suicide note.

5. Fall From Ladder - Idaho Falls, Idaho Serious Injury
April 15, 1980

An apprentice electrician employed by Amelco, a subcontractor to Jones/Boecon, fell 16 feet to the concrete while attempting to step from a ladder to a ledge of the new storage basin building under construction at the Idaho Chemical Processing Plant. Jones/Boecon is a subcontractor to Catalytic, Inc., which has the prime contract for construction of the building. The employee sustained multiple fractures and injuries to the head and chest.

Staged Reenactment of Initial Ladder Descent



Other Investigations — Entry No. 4
Fall From Ladder — Idaho Falls, Idaho

The Investigation Board believed that the probable causes of the accident included a pre-existing medical condition of the employee which resulted in dizziness and blackout, and a misstep or loss of handhold which resulted in the fall. Contributing factors to the above causes were the absence of procedures for screening and for updating the medical history of craft employees. The position of the ladder was not optimum for egress.

6. Truck Accident - Vernal, Utah
May 2, 1980

Damage to Conductor and
Transmission Line

A pickup truck belonging to the Western Area Power Administration ran off the road. It struck an electric power conductor and pulled a 138-kilovolt transmission line down across the roadway. Although the line was temporarily out of service, the accident did not result in any power outage to users.

7. Crash of Private Aircraft - Washington State
May 18, 1980

One Fatality
(Non-Occupational)
Damage to Power Line

A privately owned airplane flew into a 287-kilovolt line between Cle Elum and Ellensburg, Washington. This line of the Bonneville Power Administration dropped onto a line owned by a private utility. The pilot of the airplane was killed.

The crash occurred shortly after the first eruption of the Mt. Saint Helens volcano. It is possible that ash and dirt expelled by the volcano contributed to the accident. Efforts to obtain further information from the scene of the accident were prevented due to the restrictions on air and highway travel in the area which followed the eruption.

8. Crack in Hydrogen Sulfide Tank Spool - Aiken, South Carolina
May 19-30, 1980

Potential Release of Hydrogen Sulfide

A crack developed in a three-inch holding tank of hydrogen sulfide at the heavy water production facility (400 area) of the Savannah River Plant. Although the crack self-sealed, the potential for a release of hydrogen sulfide resulted in the evacuation of employees from the facility, the closing of the public highway and railroad that run across the plant site near the 400 Area, and restriction of air travel over the plant.

The hydrogen sulfide was successfully removed from the tank by May 29 without incident, and normal traffic was resumed.

The direct cause of the incident was failure of a defective weld (lack of penetration) in the storage tank spool. Cyclic thermal stresses induced by displacement of the piping contributed to the failure of the weld.

9. Fall Down Air Shaft - Princeton, New Jersey
June 18, 1980

Serious Injury

An employee of McGregor, a subcontractor to Terminal Construction, fell about 37 feet down an air shaft at the Tokamak Fusion Test Reactor



Other Investigations — Entry No. 8, Crack In Hydrogen Sulfide Tank Spool — Aiken, South Carolina

facility which is under construction at the Princeton Plasma Physics Laboratory. Terminal Construction is the prime construction contractor for the facility.

Prior to the accident, a piece of sheet metal had been placed over the air shaft as a weather cover and to prevent any construction debris from falling down the shaft. The employee, apparently thinking the sheet metal would hold his weight, stepped on it. The cover gave way and he fell down the air shaft. He sustained multiple fractures, cuts and abrasions.

10. Missing Plutonium Source - Upton, New York
September 3, 1980

Upon completion of a routine safeguards physical inventory of special nuclear material at the Brookhaven National Laboratory, a 0.5-gram, triply encapsulated plutonium-238 source could not be located. It was last known to be used in a nuclear physics laboratory for measurements on March 4, 1980.

After an extensive investigation of personnel, physical plant, and general operation, the Investigation Board concluded that it was likely that the source had been accidentally discarded in normal refuse during a fire-safety cleanup after the experimental measurements were completed. It was also concluded that the source was buried in the Brookhaven Laboratory landfill site.

APPENDIX C

APPENDIX C Property Loss

The total reported property loss for fiscal year 1980 was \$7,098,600. This is approximately \$3.8 million higher than losses for fiscal year 1979 but significantly lower than the \$16,355,000 reported in fiscal year 1978. Ten accidents with losses greater than \$50,000 were reported for fiscal year 1980; one, an earthquake on January 24, 1980, caused \$3.1 million property loss at the Lawrence Livermore National Laboratory, Livermore, California, and \$400,000 property damage at the Sandia National Laboratory, Livermore.

Property damage experience by the Department has been grouped together by causes in Figure C-1. Natural causes (e.g., the earthquake) and mechanical causes were responsible for two-thirds of the total loss for fiscal year 1980. Fifty percent of the total loss is attributable to

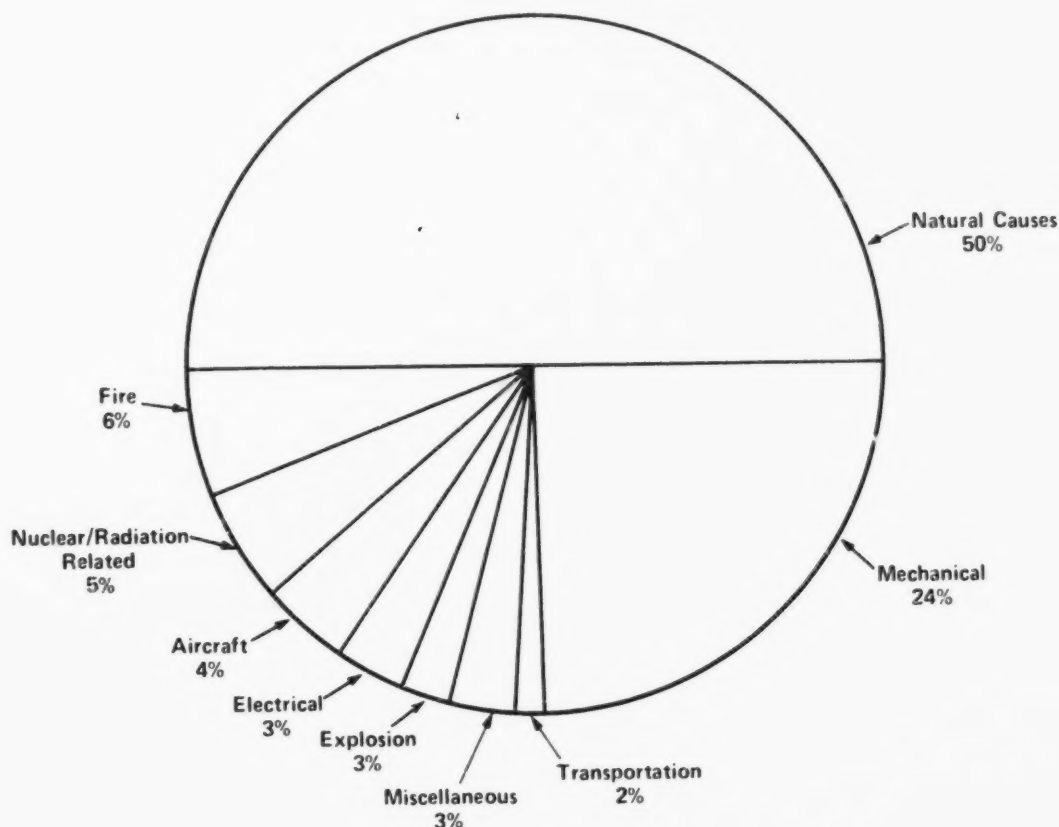


Figure C-1. Fiscal Year 1980 Property Loss

natural causes, 24 percent to mechanical causes with each of the remaining categories contributing less than 7 percent. The property loss ratio for each type of accident, expressed in terms of cents per \$100 of total Department of Energy property valuation (\$55 billion in 1980), is given in Table C-1.

Table C-1. Fiscal Year 1980 Property Loss

	Loss (\$1000)	Number of Accidents	Loss Rate (cents/\$100 Property Valuation)
Fire	421.1	26	0.08
Non-Fire			
Natural Causes	3527.2	10	0.64
Mechanical	1698.1	43	0.31
Nuclear/Radiation	349.7	10	0.06
Aircraft	307.0	1	0.06
Electrical	244.4	16	0.04
Explosion	228.4	8	0.04
Miscellaneous	203.6	16	0.04
Transportation (Cargo)	119.1	7	0.02
Total Non-Fire	\$6677.5	111	1.21
All Losses	\$7098.6	137	1.29

For those accidents causing \$100 or more in property loss, the number of accidents and the associated dollar loss are reported. Detailed reports are required for each accident causing property damage greater than \$1000. These reports include the cause of the accident, monetary damage, loss by accident type, and recommendations to help others avoid similar losses in the future.

Formal investigations are conducted of accidents that result in a property loss of \$50,000 or more. The investigations are devoted to the indepth collection and analysis of facts with resulting judgment of needs and recommendations to management.

Accidents resulting in property loss greater than \$50,000 are briefly described in Table C-2.

Fire Loss

The fire loss of \$421,000 during fiscal year 1980 was 45% less than the \$765,000 fire loss reported during fiscal year 1979. The fire loss rate accordingly fell from 0.15 cents per \$100 property valuation in fiscal

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Table C-2. Accidents Causing \$50,000 or More Property Damage

Property Damage (dollars)	Date	Location	Description
3,016,008	January 24, 1980	Lawrence Livermore Laboratory Livermore, California	Earthquake caused structural damage to building and contents
1,174,000	February 27, 1980	Hanford Reservation Richland, Washington	Concrete cover block tipped by crane into hot process pipe trench
400,000	January 24, 1980	Sandia National Laboratory Livermore, California	Earthquake caused structural damage to building and contents
307,000	March 24, 1980	Chesapeake Bay, Maryland	Helicopter missing in flight
294,000	April 8, 1980	Lawrence Livermore Laboratory Livermore, California	Plutonium contamination from glovebox
223,000	February 19, 1980	Hanford Reservation Richland, Washington	Fire caused by operation of compressor without lubrication
200,000	February 13, 1980	Naval Petroleum Reserve No. 1 Tupman, California	Building fire caused by pilot light in heater
150,000	June 12, 1980	Oak Ridge Y-12 Plant Oak Ridge, Tennessee	Elmo Bumpy Torrus electrical accident
50,000	January 22, 1980	Nevada Test Site Nye County, Nevada	Drilling rig tipped and bent frame
50,000	January 16, 1980	Nevada Test Site Nye County, Nevada	Forklift carriage dropped with load
50,000	July 17, 1980	Oak Ridge Y-12 Plant Oak Ridge, Tennessee	Gas explosion caused damage in transformer vault

year 1979 to 0.08 cents per \$100 property valuation in fiscal year 1980. The largest loss caused by a single fire was \$200,000 for the loss of a quonset hut and equipment stored in it. The remaining \$221,100 property loss resulted from 25 separate fires.

Non-Fire Loss

The total non-fire loss of \$6,277,500 reported during fiscal year 1980 was more than twice the reported non-fire loss of \$2,502,900 during fiscal year 1979. Loss rates were 1.21 cents per \$100 property valuation in fiscal year 1980 and 0.50 cents per \$100 property valuation in fiscal year 1979.

The largest single non-fire property loss of \$3,016,008 resulted from an earthquake which damaged the Lawrence Livermore National Laboratory. It included \$635,008 of programmatic losses and \$2,381,000 for plant engineering repair and cleanup. The potential for serious injuries and fatalities existed because the quake occurred during morning work hours and its epicenter was only 10 miles from the Laboratory. Several buildings experienced structural damage. Shelves, chemicals, lighting fixtures, and other overhead items, which were not properly secured, fell and injured some employees. However, several thousand employees had been trained in earthquake preparedness. Their prompt reactions helped to minimize injury and prevent loss of life. The same earthquake caused an additional \$400,000 damage to buildings and property at the Sandia National Laboratory, Livermore.

A property loss of \$1,174,000 resulted from the drop of a pipe trench cover at the Hanford Reservation. The massive cover block fell into the trench and caused extensive damage.

Two other accidents caused property loss exceeding \$250,000 during fiscal year 1980. On March 24, 1980, a helicopter disappeared during a flight from Andrews Air Force Base. The loss of the aircraft was reported as \$307,000. The other accident was plutonium contamination from a glovebox at Lawrence Livermore National Laboratory. Programmatic losses and cleanup costs of \$294,000 resulted from this accident.

Motor Vehicle Accidents

The following vehicle data were reported for fiscal year 1980:

Number of vehicles	17,580
Miles traveled	131 million
Number of accidents	768
Accidents per million miles	5.9
Dollar loss	\$535,145
Dollar loss per 1000 miles	\$4.08

A traffic accident with one fatality occurred on October 2, 1979 in Livermore, California. During 131 million miles of travel on official business, \$535,145 of property damage occurred as the result of 768 accidents. The frequency rate of 5.9 accidents per million vehicle miles and the property loss rate of \$4.08 per 1000 miles were less than half the comparable rates for all nationwide vehicle travel, as reported by the National Safety Council.

The fiscal year 1980 dollar loss of \$535,145 was an increase from the fiscal year 1979 dollar loss of \$338,400. This, however, does not reflect an increased accident frequency, because two single accidents accounted for 24% of the total dollar loss from 768 accidents. A tractor/trailer sustained \$95,000 in damages when the driver attempted to avoid hitting an on-coming private vehicle in Albuquerque, New Mexico on April 21, 1980. The second major accident occurred on a Savannah River construction site when a heavy truck ran into a steam line and caused \$41,000 in damages.